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MERIT AID AS A PREDICTOR VARIABLE OF
UNDERGRADUATE STUDENT ENROLLMENT

DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Education
at the University of Kentucky

By

Joseph Paul Bagnoli, Jr.

Lexington, Kentucky

Co-Directors: Dr. Willis Jones, Assistant Professor of Higher Education
Dr. Jane Jensen, Associate Professor of Higher Education

Lexington, Kentucky

2016

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ABSTRACT OF DISSERTATION

Merit-based financial aid has long been utilized by college and university enrollment managers to attract the most academically qualified applicants for admission. Considerable research has been done to illustrate the impact of state-based merit aid programs and other scholarly pursuits have drawn attention to the consequences of merit aid on institutional investments in need-based aid. Less is known about the efficacy of merit aid to achieve college student enrollment objectives. The purpose of this study was to evaluate the relationship between merit aid values and the likelihood of undergraduate student enrollment yield on offers of admission. The primary research question to be answered was: What is the relationship between the amount of merit aid students receive from a college or university and their enrollment decisions? The sample comprised 2,770 students at three private higher education institutions in the United States. Binary logistic regression and a forward selection process were used to test a range of possible predictors (e.g., sex, race, ethnicity, in-state residency, distance from home, academic qualifications, merit aid awards, and information from the financial aid applications of those offered admission) to determine the relative strength of merit aid in the prediction of student enrollment yield on offers of admission. The amount of merit aid offered was positively related to the likelihood of a student to enroll, even when academic qualifications and other student characteristics were controlled.

KEYWORDS: merit aid, econometric modeling, college choice, enrollment yield

Joseph Paul Bagnoli, Jr.

Student's Signature

April 6, 2016

Date

MERIT AID AS A PREDICTOR VARIABLE OF
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*To my parents, whose steadfast interest in my life's work is manifested
in these pages, thank you for your enduring support and
unrelenting confidence in me to rise above my circumstances.*

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Finally, this would never have been possible were it not for the love and conviction of my mother, Lillian Bagnoli, without whom I would never have begun nor would I have finished this process. She was my inspiration and motivation. Even in death, I have felt her pressing on me with the confidence to complete what only she could have convinced me to begin all those years ago.

Table of Contents

List of Tables	vii
List of Figures	viii
Chapter 1: Introduction	1
Organization of the Dissertation.....	3
Key Terms and Definitions	4
Merit aid, then and now.....	9
Sources of merit aid.....	11
Merit aid as an enrollment management tool	12
Private and public practices.....	12
The correlation of affluence and achievement.	13
Incentives for the affluent to enroll.	13
The external economic landscape.....	14
Institutional responses	14
Consumer “Needs” Met by Merit Aid.....	15
Financial aid sources and revenue generation	19
Purpose of the Study	21
Problem and Significance.....	22
Implications of Class Composition	23
Under-subscription	23
Oversubscription.....	25
Diversity	26
Academic preparation.....	26
Talent.....	27
Financial need profile of students.....	28
Objective Considerations of Merit Aid	28
Trends in merit aid.....	28
As a predictor of enrollment.....	30
Implications for Public Policy.....	33
Research Question.....	34
Summary of Methodology	34
Limitations and Delimitations	34
Assessing similar institutions	34
Proprietary considerations	35
Market position amongst other institutions	35
Assumptions	36
Chapter 2: Literature Review.....	37
Summary	37
Theoretical Framework	37
Influences on College Choice	40
Predicting Enrollment	42
Price and perceived quality	42

Distance from home and socioeconomic conditions	43
Foregone earnings, student ability, and peer choices	43
Psychological, sociological, and economical influences	43
A range of influences	44
Tuition discounting effects on college choice	44
Scholarly work on merit aid	45
Pioneers of merit aid research	45
An analogy to describe merit aid	46
Institutional Effects of Merit Aid and Tuition Discounting	47
State-based merit aid programs	47
Impact on low income students	48
Inflationary costs	48
Achieving Enrollment Goals	51
Academic profile	51
Revenue generation: a mixed bag	52
Gap in the Student Choice Literature	54
Differences compared to other studies	55
Chapter 3: Methodology	58
Summary	58
Conceptual Framework	58
Econometric modeling	59
Hypothesis	60
Research Design	60
Participants	60
Institutions and samples	60
Rationale for sample set	61
Student records	63
Omitted Records	64
Applicants eligible for need-based financial aid	64
Non-financial aid applicants	64
International students	65
Redundant students	66
Data Sources	66
Predictor variables in the study	66
Integrity of Data	69
SAT concordance	69
Treatment of missing data	69
Definitional differences among institutions	70
Confidentiality of student data	70
Domain expertise	71
Data coding considerations	71
Limitations related to data accuracy	72
Analysis	73
Statistical technique and variable assessment	73
Descriptive Statistics	74

Tests of models and variables.....	75
Using the model to predict enrollment	77
Assumptions of logistic regression.....	77
Limitations	78
Omitted Variable Bias..	78
Chapter 4: Results	81
Summary	81
Descriptive Statistics	81
Inferential Statistics	83
Post hoc testing.....	94
Summary of Findings	95
Chapter 5: Discussion	99
Price Responsiveness	102
Price responsiveness curves	103
Impediments to maximizing student revenue through merit aid.	103
The effect of market perceptions on enrollment yield rates	105
Future Study	105
The role of market position	105
The brand gap	107
Willingness to pay	107
Closing the brand gap.....	108
Treatment of a brand gap with merit aid	109
Modeling to inform merit award values	113
Merit aid as an ally to revenue and low income students.....	113
References.....	119
Vita.....	137

List of Tables

Table 1, Average Total Tuition, Fees, Room and Board Rates: 1981-82 to 2011-12.....	37
Table 2, Description of Independent Variables for Enrollment Yield.....	72
Table 3, Binary Logistic Regression Analysis Predicting Enrollment, Descriptive Statistics.....	87
Table 4, SPSS Model Summary Output, HEI #1.....	89
Table 5, SPSS Model Summary Output, HEI #1.....	89
Table 6, SPSS Model Summary Output, HEI #1.....	89
Table 7, SPSS Classification Table Output, HEI #1.....	91
Table 8, SPSS Classification Table Output, HEI #2.....	91
Table 9, SPSS Classification Table Output, HEI #3.....	92
Table 10, SPSS Output of Forward Stepwise Conditional Method, HEI #1.....	93
Table 11, SPSS Output of Forward Stepwise Conditional Method, HEI #2.....	94
Table 12, SPSS Output of Forward Stepwise Conditional Method, HEI #3.....	95
Table 13, Simulation of Merit Aid Offers and Likelihood of Enrollment at Three HEIs.....	100

List of Figures

Figure 1, Illustration of a financial aid package that is insufficient to meet demonstrated financial need.....	22
Figure 2, Illustration of a financial aid package that meets 100% of demonstrated need but when a family does not believe they can pay the EFC.....	23
Figure 3, Illustration of a financial aid package that meets 100% of demonstrated need and a family believes they can pay the EFC.....	23
Figure 4, Percent of total revenues contributed toward higher education since 1947.....	25
Figure 5, Average institutional grant aid, publics: 2000-2013.....	35
Figure 6, Average institutional grant aid, privates: 2000-2013.....	36
Figure 7, Percent growth rate in current dollar prices for goods and services as compared to higher education cost increases since the early 1980s.....	53
Figure 8, Probable predictors of enrollment yield.....	63
Figure 9, Yield simulation curves for three HEIs.....	102
Figure 10, Chain reaction of merit aid reduction.....	117

Chapter 1: Introduction

The award of scholarships to college-bound students is a tool that is increasingly utilized to manage enrollment by higher education institutions (Monks, 2009).

Scholarships have played an important role in facilitating undergraduate student enrollment at a time when the costs associated with higher education have outpaced the capacity of State and Federal governments and the family incomes of college-bound students to meet those costs (Ehrenberg, 2000). Searching for ways to increase revenue from students, colleges and universities have turned to enrollment managers and the practice of tuition discounting (Lapovsky & Hubbell, 2003; Parrott, 2008). In the form of scholarships (also known as merit aid awards) which ostensibly recognize student achievement, institutions of higher learning increasingly use incentives to enroll students help meet a variety of enrollment-related goals, not the least of which is tuition revenue (Heller, 2006).

Though perhaps counterintuitive, if a college or university can, through financial aid incentives, compel high performing students from wealthy families to enroll, they may be able to generate student revenue to replace the lost funding from government sources in order to fund their costs of operation (Hillman, 2012). Many journalists, authors, and experts in higher education object to this use of merit-based financial aid on the grounds that it is being spent to attract students from wealthier families at the expense of siphoning funds from institutional need-based financial aid budgets for students with financial need (Baum, 2007; Dynarski, 2000; Hechinger & Lorin, 2013; Redd, 2000). The potential consequences of tuition discounting for low income, underrepresented

students in higher education are a source of concern for many colleges and universities. However, without a more viable alternative to fund their operational budgets, many institutions engage in the practice of tuition discounting (Martin, 2004). Sometimes referred to as *price discrimination*, *financial aid leveraging* or *differential financial aid packaging*, the use of tuition discounting through the award of merit-based financial aid was defined by Davis (2003) as, “The art and science of establishing the net price of attendance for all students at amounts that will maximize tuition revenue while achieving various enrollment goals” (p. 2).

Concerns about the potential impact of providing discounts for affluent students notwithstanding, the award of merit-based financial aid has a potential benefit that is often overlooked by the popular press and in the scholarly literature on merit aid. The amount of merit aid awarded to college-bound students is among the variables that influence where students choose to enroll. Those responsible for student recruitment have begun to recognize the predictive qualities of merit aid awards on the likelihood of enrollment (DesJardins, Ahlburg, McCall, & Patrick, 2006). Merit aid, therefore, may serve the important purpose of assisting colleges and universities to precisely design classes of best-fit new students.

This study focused on the relationship between merit aid and student enrollment yield, controlling for several variables including student academic credentials, financial aid application information, and other student characteristics. Through binary logistic regression and a forward selection process, a range of possible predictors were tested to determine the relative strength of merit aid in the prediction of student enrollment yield on offers of admission. The study adds to the college choice literature an analysis of

merit aid's impact on students' college selection decisions represented by enrollment yield on offers of admission. Given the claims of popular press that institutions award merit aid at the expense of need-based aid, the introductory context for this study includes an investigation of actual investments made in both institutional merit-based and need-based financial aid. The implication of frequent criticisms of merit aid is that its means to accomplish particular enrollment goals cannot be justified by its ends; that if merit aid diminishes institutional investments in need-based aid, any advantage it may create for higher education institutions cannot be justified. Therefore, a careful assessment of trends regarding institutional investments in need-based aid was undertaken as a component of the introduction.

Although generalized institutional patterns of financial aid spending are relevant to contextualize this study, the unit of analysis was the student and, in particular, the impact of merit aid on college choice. As outlined below, considerable research on merit aid has been undertaken with a focus on institutional effects but this study was dedicated to understanding how the probabilities of enrollment were affected by offers of merit aid.

Organization of the Dissertation

This dissertation is organized into five chapters. This introductory chapter describes key terms and definitions as well as key elements of the internal and external landscapes of higher education that inform institutional use of merit aid. It explains the importance of accurate targeting of new student enrollment and introduces pertinent mechanics. The problem and significance of the study is described and the research question introduced. The second chapter is devoted to a review of the literature and an explanation of how this particular study fits into the scholarly conversation about merit

aid, college choice, and predicting student enrollment. The third chapter includes a framework for the study and a presentation of the methodology designed to answer the research question. Chapter four includes the results and findings of the study, followed by a discussion of the findings and opportunities for further study in chapter five.

Key Terms and Definitions

Brand: All the thoughts, feelings, and associations one conjures up when contemplating a particular product, organization, service, or in this case, a college or university (D. Schultz, Patti, & Kitchen, 2013).

Carnegie Classification: a framework created by the Carnegie Foundation for classifying colleges and universities in the United States (McCormick & Zhao, 2005).

Comprehensive Fee: The price of attendance that includes tuition, fees, room and board. The comprehensive fee is not always equal to the cost of operations. Some HEIs establish the fee above the cost of operation and others charge less than the actual cost per student.

Conversion Rate: The percentage of students who inquire about the possibility of admission and later apply for admission.

Demonstrated Need: The difference between a student's Expected Family Contribution (see definition below) and the total of direct (tuition, fees, room, and board) and indirect (books, supplied, travel, personal, and miscellaneous expenses) costs associated with enrollment (Cabrera, Nora, & Castaneda, 1992).

Discount Rate: See Tuition Discount Rate.

Early Decision: A mechanism through which applicants for admission are required to make an early (typically late fall or early winter) binding commitment to

enroll at an institution in exchange for a better chance of success than in the regular admission process.

Enrollment Manager: An individual assigned responsibility for recruiting and enrolling a class of students who will ideally meet the objectives of the HEI.

Expected Family Contribution (EFC): The amount of money a family is assigned responsibility for paying toward the costs of attendance as derived from completion of the Free Application for Federal Student Aid (Kane, 1994).

Felt Need: The experience of a family who believes it cannot contribute as much to a student's education as the value identified through the Free Application for Federal Student Aid (FAFSA) as their Expected Family Contribution (EFC).

Financial Aid: Grants, loans, or self-help (see definition below) awarded to a student to assist families with the costs associated with attendance.

Financial Aid Leveraging: A revenue generating strategy or practice of preferentially awarding combinations of need-based and/or merit aid to students in an effort to expend only the necessary institutional resources required to enroll the student (Hossler, 2000).

Financial Need: The difference between an HEI's comprehensive costs of attendance minus the EFC.

Financial Need Gap (or Gap): The balance remaining after EFC and the financial aid award are subtracted from the comprehensive fee.

First Generation Student: A degree-seeking college student whose parents have not themselves earned a college degree.

Free Application for Federal Student Aid (FAFSA): A form used by the US Department of Education, States, and HEIs to collect information related to a student's household resources in order to determine what financial contribution will be expected (their EFC) toward college costs and their consequent eligibility for need-based financial aid.

Full-Pay Student: A student who pays the entire comprehensive cost of attendance to enroll.

Grants: Also referred to as "gift aid", a form of financial aid that does not require repayment.

HEI(s): Higher Education Institution(s).

Institutional Financial Aid: There are several revenue sources for institutional financial aid including restricted and unrestricted annual gifts to the college, revenue from restricted and unrestricted endowments, the college's financial aid budget appropriations and, in the case of public institutions, State allocations given to the institution for student financial aid purposes.

Isomorphism: The tendency of an organization to influence and be influenced by a range of pressures and forces both external and internal to that organization (Powell & DiMaggio, 2012).

Loans: A form of financial aid that requires repayment, often with interest.

Market Position: The perception of an institution's strengths and desirability relative to competitors (other colleges) of interest to prospective students and those who influence them (Matear, Gray, & Garrett, 2004).

Matriculant: A student who enrolls at a college.

Merit Aid: Financial aid that is awarded to a student by a HEI in recognition of academic achievement or student characteristics that are desirable to the college or university (Dynarski, 2004).

Need-Based Aid: Financial aid that is awarded to a student to meet some or all of their demonstrated need but that does not exceed their financial need.

Net Price: The cost of attendance after all forms of financial aid have been subtracted from the comprehensive fee.

Net Tuition Revenue per Student: The average balance due of the total comprehensive fee minus the financial aid awards for a cohort of students.

Over-award: The condition present when a financial aid package (not including loans or self-help) exceeds the amount of demonstrated need (Elliott, 1980).

Pell Grant: A national need-based, higher education grant program for which those with significant financial need may qualify.

Price Responsiveness (Elasticity): The relationship between merit aid, the resulting net price of attendance and enrollment yield.

Regular Decision: A timeframe in which applicants for admission apply for admission to a college or university, typically in the winter and early spring.

Self-Help: A form of financial aid estimated at the amount of money a student can earn toward school expenses through a job during the academic year or periods of leave. This form of financial aid may be used by the student to pay direct expenses to the HEI but is typically applied toward indirect costs of travel, books and supplies, personal and miscellaneous expenses.

Stacking: The practice of assembling a financial aid package with more than one award, regardless of whether or not additional awards exceed the amount of demonstrated financial need of the recipient.

Test Optional Admission: An option extended to applicants for admission to college who, by exercising the option, may elect for an admission committee to disregard when reviewing their applications any standardized test scores submitted in conjunction with other application materials (Syverson, 2007).

Tuition Discounting: The practice of differential reductions in tuition and fees offered in the form of student financial aid and used by HEIs to promote the enrollment of students who without financial assistance would be unlikely to attend their colleges or would assume significant educational debt burden (Allan, 1999).

Tuition Discount Rate (or Discount Rate): Defined by the National Association of College and University Business Officers (NACUBO) as the total tuition and grant aid divided by the total gross tuition and fee revenue. The rate does not include a reference to room and board charges or corresponding financial aid because not every college offers on-campus housing. Therefore, tuition discount rate, or simply “discount rate” is a metric that can be used to compare financial aid practices across institutions and sectors. It also does not include the foregone income associated with tuition remission or exchange programs.

Tuition Exchange: A tuition benefit program shared by a consortium of other institutions typically offered to full-time employees of a college or university that permits the employee’s dependent(s) to enroll, at a reduced or eliminated tuition cost, at another institution (Dur & Unver).

Tuition Remission: A tuition benefit program typically offered to full-time employees of a college or university that permits the employee's dependent(s) to enroll at their employing institution at a reduced price (Siegfried & Getz, 2006).

Tuition Revenue: The total revenue generated through direct tuition payments made by all enrolled students and their families.

Willingness to Pay: The amount of family resource those involved in the support of a college-bound student are willing to render in order to make enrollment possible.

Work-Study: A form of self-help provided first to students with demonstrated financial need but often available to others who wish to earn money through having a job while enrolled in college.

Yield Rate: The percentage of students offered admission who enroll.

Merit aid, then and now. The practice of awarding scholarships was once reserved for outstanding college-bound students who, in comparison to their peers, had achieved academic distinction. As early as 1955, the privately funded National Merit Scholarship program conferred awards on students with outstanding academic credentials (Dynarski, 2004). As implied by their alternate moniker, "merit awards," scholarships often had overseers, boards, or advisers deeply engaged in the determination of achievement and student selection (McPherson & Schapiro, 1998). Like colleges and universities, local, high school, and community-based organizations have for many years awarded and announced scholarships to college-bound students. Often, recipients are selected through a competitive process that requires an application, letters of reference, and sometimes an interview. Still today, recipients of merit awards are celebrated in their

local communities where announcements of their awards are often synonymous with decisions of where they plan to attend college.

Until the practice of discounting tuition by private higher education institutions (HEIs) in the United States emerged in the 1970s, scholarships were typically funded by various organizations, institutions, and agencies beyond college campuses (Dynarski, 2004). These awards had criteria associated with their qualifying and selection processes and their names often reflected those criteria (e.g., leadership scholarship, citizenship scholarship, service scholarship, academic achievement scholarship). HEIs began discounting tuition through the award of scholarships that were often named in acknowledgment of student achievement. However, these new “merit awards” were no longer so typically funded through a philanthropic source or third party. By foregoing the full sticker price of attendance in order to generate at least some revenue from the families of students that could make a substantial contribution to the costs of education, the higher education community borrowed from the business sector a practice known today as “financial aid leveraging” (Redd, 2000).

Today, many colleges and universities have eliminated the formality of an application for scholarships and simply use the materials collected in conjunction with an application for admission to determine recipients of merit awards. What once represented a high bar of entry for select emerging scholars has become more commonplace and no longer requires the same level of demand for applicant achievement or engagement in a competitive process. These merit awards are no longer reserved for a small percentage of college-bound students (Woo & Choy, 2011). Now that they are simply discretionary discounts offered by HEIs and not limited by what an independent

donor has contributed for the award, it is possible for more students to receive these “unfunded” discounts even if they have not demonstrated the same level of distinction once required by a third-party donor. As determined by Woo & Choy (2011), between 1995 and 2007, merit awards given by HEIs more than doubled from 6% to 14%.

Sources of merit aid. Institutional merit aid awarded by HEIs comes from three general sources: 1) the expendable return on endowments and named scholarships that have been established by gifts from donors to a college or university (e.g., presidential scholars, leadership awards, talent or achievement prizes); 2) institutional appropriations for merit-based financial awards funded by operating budgets; and 3) unfunded “discounting” of a college’s price through foregone income. Because they are typically named alike, these sources are often indistinguishable to students, their advocates, public policy makers and, arguably, scholars who without a requisite background in the vernacular of financial aid can easily mistake one source of financial aid for another.

One consequence of common merit aid naming conventions is that it is not always clear when HEIs are themselves responsible for the funding of merit awards through philanthropic cultivation of their alumni and other third parties. It can also be difficult to discern when a merit award is little more than a manifestation of administrative strategy at a HEI to forego some of the student revenue that would be generated by charging the full comprehensive fee associated with enrollment in order to better ensure a significant portion of the fee is collected through the enrollment inducement of a merit aid offer (Brooks, 1996). A HEI might conclude that it is preferable to collect some revenue from a student who will only enroll if the price is discounted than to risk all the revenue lost by charging more than a student is willing to pay.

Merit aid as an enrollment management tool. Merit aid is a tool through which enrollment managers (people charged with responsibility for meeting various student enrollment objectives) can achieve specific goals associated with an entering class such as the class size, academic qualifications or profile, demographic and multi-cultural characteristics, outstanding athletic or artistic talents, and net student revenue (Ehrenberg, Zhang, & Levin, 2005). There is some evidence to suggest that it may also be a reliable predictor of and serve to influence enrollment yield on offers of admission (i.e., the percentage of students from among those offered admission who choose to enroll); (Avery & Hoxby, 2004; DesJardins et al., 2006). For a variety of reasons addressed below, it is critical that enrollment managers, especially at colleges with limited capacity for student enrollment, find accurate ways of projecting how many of those offered admission are likely to enroll.

Private and public practices. Using merit aid to manage enrollment and shape the academic profile of entering classes of students began with private HEIs that were trying to compete for students that could more easily afford to attend public HEIs where tax subsidies resulted in lower prices of attendance (Dynarski, 2004). As State appropriations for higher education began to diminish, public institutions started utilizing merit aid to keep enrollment affordable and to compete with private colleges for student enrollment (Priest & St. John, 2006). During the years of rapid increases in tuition and fees beginning in the latter part of the 20th century, the practice of awarding merit aid to students became more prevalent. Some speculate that the award of merit aid became a pricing strategy designed to boost the academic profile of a college. Like the arms race for prestige that led to landfills containing expensive, attractively designed college

marketing publications (W. G. Tierney, 2008), merit aid's purpose was to enroll students with higher academic credentials (Redd, 2000).

The correlation of affluence and achievement. Perhaps because deviations in household incomes were less pronounced in the 20th century, the socio-economic status of qualified scholarship recipients was less predictable. As social science research would eventually discover, however, advantage in such contests was conferred upon those with a head start. Students with access to significant social, cultural, human, and financial capital were more likely to demonstrate achievement and be selected for scholarships (Woo & Choy, 2011). Eventually, enrollment managers at HEIs began to observe the strong correlation between significant household income and academic achievement (Yeung & Conley, 2008). Many of them also recognized the strategic advantage of sponsoring merit awards for students with high standardized test scores (e.g., ACT or SAT) who they could be reasonably sure would come from households with greater wealth. The awards could be used to entice students with strong academic credentials who might not otherwise consider (or as seriously consider) the possibility of enrollment at their institutions.

Incentives for the affluent to enroll. The socially acceptable title of “merit aid” serves to dignify this enrollment incentive strategy deployed by several institutions today—private and public alike. An unsuspecting public appears to prefer and respond more favorably to scholarships than to enrollment incentives (Avery & Hoxby, 2004). Hence, labels like “Presidential Scholar” emerge to attract the attention of desirable prospects for admission and influence the rate at which they respond to offers of admission and scholarships.

Enrollment managers also discovered that merit awards engendered in students and their influencers a particular loyalty to their HEIs; that parents and students would “justify” enrollment choices by indicating that the student earned a scholarship to attend a particular institution. What started as a means through which to confer a prize upon students who worked hard to achieve success eventually became a strategy through which to both identify the financial capacity of a family to contribute tuition and fee revenue to HEIs and to develop loyalty to a particular college or university (Dynarski, 2004).

The external economic landscape. Annual inflation-adjusted median household incomes rose by less than \$10,000 between 1982 and 2008 (DeNavas-Walt & Proctor, 2014) and in the post-recession years since 2009 remained stagnant through 2013 (US Department of Commerce, 2013). During this period, the share of higher education costs assigned to students continued to increase (Desrochers & Hurlburt, 2014). These trends produced a growing gap between the price of higher education and family financial resources available to support the pursuit of an undergraduate degree. These gaps have implications for HEIs that must contend with the struggle to render adequate financial aid to make enrollment affordable for admitted applicants but not to expend so much in financial aid dollars to make their institutional funding models unsustainable.

Institutional responses. During the global financial crisis of 2009, some speculated that the higher education bubble would be the next to burst (Cronin & Horton, 2009). How could colleges keep raising prices if families were increasingly unable to afford the cost of tuition? Some colleges and universities with a practice of ignoring the financial capacity of a student to contribute toward the costs of education abandoned their former practice of need-blind admission (Brint, 2010). A declining number of

institutions sponsor both a need-blind admission practice in which applicants for admission are not judged on the basis of their family's capacity to fund their education and an institutional financial aid program that meets all of the financial need that each admitted student demonstrates (Machung, 1998).

Instead, more HEIs are adopting an admission practice called “need-sensitive” admission where the financial capacity of an applicant's family is one consideration in the admission process. HEIs that select this approach strategically reduce the number of enrolled students whose families cannot underwrite as much of their costs. In such cases, where a particular applicant's financial need is perceived as requiring too much of an institutional investment in financial aid or there is not some institutional advantage to be gained by the admission of a particular candidate (e.g., academic or talent profile of the entering class, leadership capacity, racial diversity) admission is denied an applicant that may have the basic qualifications for admission (Stevens, 2009).

Consumer “Needs” Met by Merit Aid

One can assume that merit aid meets a need or desire for students and their advocates. Otherwise, HEIs would be less likely to invest in it. Even with significant financial aid, enrollment at a particular college is sometimes viewed as cost-prohibitive by students and their families. In part, this experience of perceived inability to afford college is a by-product of the nationalized system in the United States for analyzing the capacity of a family to contribute toward higher education costs for a student. The Free Application for Federal Student Aid (FAFSA) and its corresponding formula—the Federal Methodology—for determining what a student's family should be expected to contribute toward the cost of college serves as a rationing system for limited Federal

dollars allocated to student aid. The FAFSA calculation of how much a student's family can afford to contribute to their education is utilized to develop a student's financial aid package. If, for example, a family is judged to be capable of contributing \$12,000 toward a student's education and the total cost is \$43,000, a financial aid office will conclude that a student has a demonstrated need of \$31,000 ($\$43,000 - \$12,000 = \$31,000$). The calculation of what a family should contribute, however, often disagrees with what families say they have available for the funding of higher education from household income, businesses, savings, and assets. When a college assigns financial responsibility to the family in the amount of that calculation, therefore, families often react by suggesting that too much is being expected of them. Such a reaction has implications for the college choice decision.

Certain assumptions reflected in the needs-analysis of a family's financial circumstances are made about what portion of discretionary household income should be available for educational expenses. This is referred to in the financial aid vernacular as Expected Family Contribution (EFC). Families, of course, make divergent spending decisions. Some invest in private school education for their children, vacations, entertainment, vehicles, etc. Depending upon consumption behaviors, costs of living, and other financial obligations, families often conclude that what they are expected to contribute to their student's education (the EFC) is not feasible. In such cases, even when financial aid is provided to meet 100% of a student's *demonstrated need*, families will experience what financial aid professionals refer to as "felt need." Felt need is the experience of believing that one's family has been inaccurately judged to be capable of paying more than what they can afford. A family might say, "I know the calculation says

that my demonstrated financial need (the costs of attendance minus what the family is expected to contribute) is \$12,000, but I'll need a lot more help than that to pay the bill."

When demonstrated financial need remains after a financial aid award is assembled or when the burden of felt need exceeds the desire of a student (and the student's influencers) to enroll, that student may decline an offer of admission, indicating that the price of enrollment is simply too high.

In some cases, especially at colleges and universities that lack the financial resources to provide the requisite financial aid to meet 100% of demonstrated financial need for all of their admitted students, a financial aid gap (between what is billed and what a family is judged as able to contribute toward costs) occurs. In these instances, a student's financial need is said to be *unmet*. Figure 1 is an example of a financial aid package with such a gap. These gaps represent one factor students and their families consider when arriving at an enrollment decision at a specific HEI.


TOTAL FINANCIAL NEED				
Expected Family Contribution	Grants	Loans	Student Work	Gap
TOTAL SUPPORT				 Inadequate Aid to Meet Demonstrated Need

Figure 1. Illustration of a financial aid package that is insufficient to meet demonstrated financial need.

Sometimes a HEI awards enough in financial aid to meet all demonstrated financial need but because the family believes it can only contribute a portion of what is expected of them, they have a "felt need." This is illustrated in Figure 2.

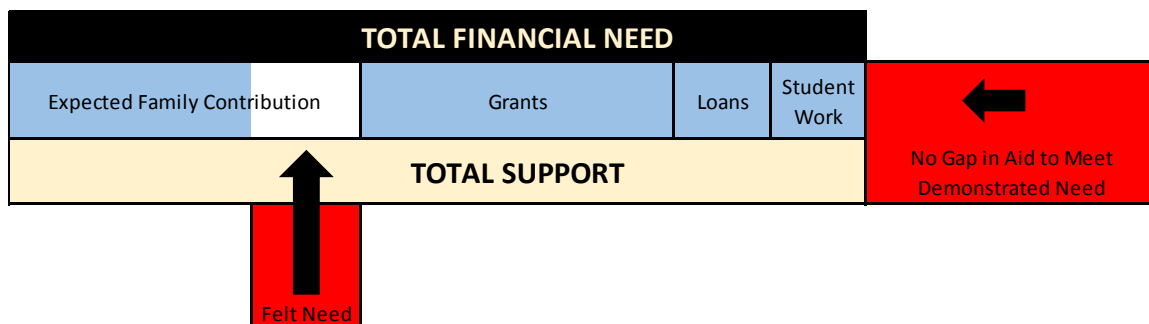


Figure 2. Illustration of a financial aid package that meets 100% of demonstrated need but when a family does not believe they can pay the EFC.

Even if all financial need has been met by a financial aid package and no felt need is experienced as in Figure 3, the value a family assigns to enrollment of a particular HEI influences their willingness to pay the net price of attendance. Whether or not they are willing to pay the balance due after financial aid is applied is partially a function of the value they associate with a given HEI's institutional brand. Two families with equal financial resources may respond differently to a comparable offer of financial aid from the same HEI. In one case, when a student and those who influence her believe the price of enrollment is worth it, she may enroll. In another, when she is less certain of the value associated with enrollment, she may elect not to enroll. Several things that may account for different enrollment decisions were explored in this study but the primary focus was to isolate the impact of a merit aid offer on the likelihood of enrollment.



Figure 3. Illustration of a financial aid package that meets 100% of demonstrated need and a family believes they can pay the EFC.

As suggested, the merit aid offer may serve to meet felt need or create an inducement that compensates for a perception of lower value than the assigned net price. This study did not attempt to distinguish the difference between the two. Rather, its focus was to analyze the relationship between the value of the merit aid offer and the likelihood of enrollment.

Financial aid sources and revenue generation. Without financial aid and scholarships, many Americans (not just those from low income households) could not afford to pursue a four-year college degree. The national system of financial aid in the United States is built on the premise that government assistance for higher education is to provide “last dollar” support to college students only after a family has made whatever contribution is concluded they can make to their student’s education. Because household incomes have not kept up with the costs and prices associated with higher education, an increasing share of students come from families that cannot fund from their resources the entire cost of education. To help families pay for education, financial aid is awarded in various forms and is available from different sources. Scholarships and grants—sometimes in the form of merit aid—reduce the total price of education for students across the socioeconomic spectrum.

Sources of funding external to the student’s family of origin have also not increased at the same rate as the cost of attendance. State and Federal sources, at one time covering a significant share of costs, have not kept up. Figure 4 (see below) demonstrates the decreasing purchase power of these aid sources. Since 1980, support

from States in the form of direct, need-based financial aid to students has been reduced over 40% or \$42 billion (Mortenson, 2009a; Weerts & Ronca, 2006) and although the Federal need-based Pell Grant has rarely seen a decrease in student award values, it covers a diminishing portion of college costs over time (Baum & Steele, 2007).

Consequently, HEIs and their enrollment managers seek recruitment strategies and financial aid methods that can generate revenues to both replace losses in subsidies that are less available through State and Federal government grants and compensate for the rate at which costs at their institutions have grown faster than household incomes. As described previously, one such revenue strategy is the use of scholarships, discounts, or merit-based financial aid (hereafter referred to as “merit aid”). Through the award of merit aid, HEIs create an enrollment inducement to ensure that a variety of institutional enrollment goals (e.g. size of entering classes, academic qualifications, talent and racial diversity) are met, not the least of which are goals associated with net student revenues.

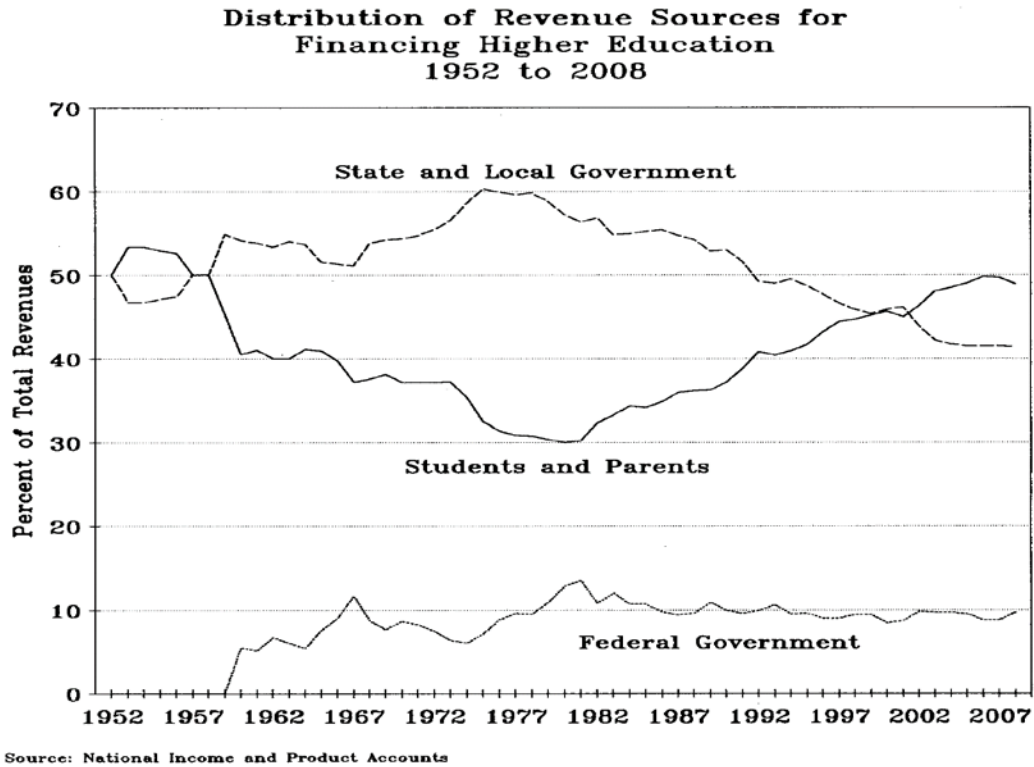


Figure 4. Percent of total revenues contributed toward higher education since 1947. “Distribution of Revenue Sources for Higher Education” National Income and Product Accounts (as cited in Mortenson, 2009).

Purpose of the Study

This study examined the predictive power of merit aid on student enrollment and answered the question, “Can the value of a merit aid award be used to improve the accuracy of predictions related to the enrollment choices made by students?” Controlling for academic credentials, financial aid application information, and other student characteristics, the study isolated the effect of merit aid on student enrollment and concluded that there is a strong, positive relationship between merit aid and student enrollment. The relationship of merit aid to student enrollment provides enrollment managers a tool through which to more precisely design the size and characteristics of entering classes of college students.

The literature review includes a comprehensive assessment of the student choice literature (i.e., what is already known about how students choose a college to attend) with a focus on studies that have included an assessment of the relationship between merit aid and college choice. By demonstrating the increased probability of accurate enrollment predictions based upon offers of merit aid, this study adds complexity to the contentious national discourse on the potential negative consequences of using merit aid as an enrollment management strategy. Institutional effects notwithstanding, this study extols an important virtue of merit aid—its contribution to the effective management of the composition and size of a student body. For reasons outlined below and related to the efficacy of a HEI to engage and achieve its mission, the size of a student body is essential to the ability of faculty, staff, and administration to deliver an optimal education experience to enrolled students.

Problem and Significance

Enrollment managers are assigned responsibility for the enrollment of an entering class of students who align with institutional enrollment goals (i.e., size, diversity, academic preparation, talent, revenue). The composition of an entering class demonstrates fulfillment of institutional commitments and reflects more or less favorably upon colleges and universities. The entering class contributes to funding of operational costs through revenue from tuition, fees, room, and board charges. Several factors influence the capacity of enrollment managers to enroll their target classes of entering students. Included among those are the reputations or brands of their institutions, the marketing materials available for communicating the identity and value of their institutions, the perceived desirability of enrollment on the part of prospective students

and those who influence them, and the price associated with enrollment. As illustrated through the study of college choices among students enrolled at independent high schools, financial aid can enhance a student's interest in a college, perhaps by compensating for other objections to enrollment (Avery & Hoxby, 2004). Financial aid also can provide a means through which an enrollment manager may project likelihood of enrollment and modify recruitment strategies to influence enrollment choices in order to assemble with precision a class of entering students who reflect institutional commitments and values (Leeds & DesJardins, 2015).

Implications of Class Composition

Under-subscription. The importance of effectively managing enrollment can be found in the negative financial consequences of failing to enroll the target number of new students sought by an HEI. Operational budgets are built upon enrollment projections. Spending decisions are often reached well in advance of the beginning of an academic term. When too few students enroll, tuition revenues can fail to keep pace with expenditures. Some HEIs have financial reserves in place to compensate for a drop in student enrollment, but successive decreases in enrollment can lead to subsequent budgetary cuts, radical transformation of the mission of a college or university and, in the most persistent and egregious cases, closure.

The recent proliferation of the Common Application that facilitates the application for admission of college students to hundreds of participating HEIs challenges enrollment managers to accurately project yield on offers of admission to their institutions. As students have begun to apply for admission to a greater number of colleges and universities, enrollment managers sometimes have been misled by the sheer

volume of applications for admission to their institutions. Expecting admitted applicants to enroll at rates similar to what they observed prior to their participation in the Common Application process, some enrollment managers found that a smaller percentage of those admitted were actually committed to enrolling. Consequently, too few students results in under-subscription and there have been many examples of this nationally in recent years. A 2014 survey of enrollment managers revealed that over 75% of enrollment managers were concerned about not reaching their enrollment goals (Jaschik & Lederman, 2014). Unlike most businesses that observe revenue streams in advance of operational spending decisions, HEIs must make spending decisions (e.g., hire faculty, establish food service contracts, staff a health service operation) before they account for annual revenues. Operational reserves can serve to compensate for this uncertainty, but many HEIs don't have the luxury of unrestricted and large endowments to react to a sudden drop in enrollment. Consequently, HEIs are already overcommitted to operational costs by the time they discover a sudden drop in enrollment. Having too few students enrolled to assist with the financial commitments of the institution is often referred to as "not making the class."

Presidents, chief financial officers, and chairpersons of trustee boards await enrollment reports from their enrollment managers with trepidation. Did the enrollment office "make the class" and did they generate adequate revenue to fund operations? This scenario is played out on college campuses across the United States every fall semester, leading a recent article in the *Chronicle of Higher Education* to refer to the enrollment manager's position as, "The Hottest Seat on Campus" (Hoover, 2014). The temptation is

great for enrollment managers to utilize any means available to remove uncertainty in the student recruitment process and better ensure that their classes come in “on target.”

Oversubscription. Some institutions have overreacted to the drop in yield resulting from the Common Application by offering too many students admission (Liu, Ehrenberg, & Mrdjenovic, 2007). Consequently, and for reasons sometimes unrelated to the Common Application (e.g., shifts in market demand, changes in operational recruitment practices, swings in the economy or workplace dynamics, limitations in predictive models), some classes have become oversubscribed. Oversubscription of an entering class often has the advantage of generating additional student revenue but can lead to a variety of institutional challenges that ultimately compromise the quality of experience for enrolling students. The challenges of oversubscription may be most immediately felt by institutional representatives and students engaged in the process of advising and course registration.

Exceeding the number of target students may mean that available teaching faculty or professional academic advisors may not have adequate time to properly advise all students. Available seats in classrooms cannot always easily accommodate an increase in enrollees. Students may find themselves unable to register for the courses required for timely progression to a degree. When extra chairs are added to a classroom not designed to accommodate them or extra students are registered for a class beyond the number that is manageable for a faculty member, the quality of instruction, interaction among students, or timely feedback from a professor on academic work can be compromised.

Academic resource centers, the staffs in libraries or reading, writing, and math labs may also be unable to meet the need for support represented in a larger than expected

class of students. Often, it is difficult to know which students intend to enroll until the final weeks preceding an academic term when teaching faculty on summer leave are unavailable to dialogue about optimal solutions and there is insufficient time to react to the expanded size of the group in a coordinated fashion. Given this range of institutional constraints, oversubscription can sometimes lead to a prolonged path for students to complete their degrees. It can serve to weaken the academic experience of enrolling students, frustrate teaching faculty and staff who cannot keep pace with the sudden increased demand for services, and compromise the reputation of an HEI.

A larger than projected class can also have implications for residence hall placements, sometimes leading HEIs to rent local hotels in order to accommodate the additional students or placing more students in a room than it is designed to accommodate. These responses to oversubscription can clearly compromise the efficacy of programs that are designed and funded to serve a smaller number of new students.

Diversity. Many institutions have missions that include commitments to diversity. Racial, ethnic, geographic, socio-economic, and international diversity are often espoused for their contribution to the educational and residential experiences a HEI wishes to offer its student body. A homogenous class of entering students can limit the range of academic experiences and perspectives that students have both within and beyond the classroom. For many HEIs, enrolling a diverse class of students is an essential element of class composition (Gurin, Dey, Gurin, & Hurtado, 2003).

Academic preparation. When enrollment managers are struggling to enroll enough students at their institutions to generate revenues necessary to cover operational expenses, they sometimes resort to approving for admission students who lack the

academic preparation to be successful upon arrival. Curricula are designed by teaching faculty to meet the anticipated academic needs of an entering class of students. Some HEIs do not offer any or enough developmental courses for students who require remediation upon matriculation. When the academic qualifications of an entering student body do not align with the curricula designed to meet their needs upon arrival, some students can find themselves enrolled in courses where the content or demand is beyond their intellectual capacity. In such cases, teaching faculty may be confronted with the inauspicious option of moving too quickly through course material for ill-prepared students or too slowly through material for eager students who are prepared to move forward. Such a mismatch of student and HEI may lead to poorer retention.

Talent. Academic communities generally endeavor to produce high quality results in the creative and performing arts, athletics, and a variety of extra-curricular clubs and organizations. Consequently, enrollment managers are often charged with the enrollment of students who will contribute to the HEI's capacity to achieve distinction in these areas. Outstanding performances, works of art, competitions and contests of various kinds enlarge participant capacity to imagine themselves as vital contributors to their college communities and, ultimately, the places they will live and work upon graduation. HEIs seek to identify students with passion for such out-of-classroom pursuits and hope to further engender in them an appreciation for the creative and performing arts, sport, recreation, and wellness. Failure to enroll students who can contribute to the level of excellence sought by the faculty and staff at HEIs with such commitments can disrupt the quality of their programs. To the extent that low enrollments compromise the confidence of a student to perform a specific task as part of

a group (e.g., art or theatre performances, athletic contests, debate, mock trial) undersubscription could contribute to diminished self-efficacy and, consequently, the achievement of an individual student and, by extension, those around them (Bandura, 1982).

Financial need profile of students. The financial need profile (or conversely, the wealth profile) of an admitted class of students impacts the level of institutional financial aid required to enroll the class and achieve enrollment objectives (e.g., student revenue). If the class, as a whole, comes from households with significant affluence, less institutional financial aid is required to meet the financial need represented in the class. If, however, a large share of students in the class are from households that cannot afford the comprehensive fee associated with enrollment, more institutional aid will be required to ensure their enrollment. To the extent that financial aid influences the choice of students to enroll at a particular HEI, it may be important to the aforementioned enrollment-related goals to utilize financial aid in order to leverage the enrollment of those attractively qualified students to whom admission is offered.

Objective Considerations of Merit Aid

Trends in merit aid. The contentious debate about the impact of merit aid on an institution's commitment to need-based aid can be informed by answering an empirical question: Have HEIs invested less resources in need-based aid to meet student need over time? The surprising answer, given the public derision of higher education, is "No." In fact, need-based aid as a percentage of total institutional grants increased from 29% in 2000 to 48% in 2013 (Baum, Elliott, & Ma, 2014). Merit aid is best understood within the context of total student revenue and the disbursement of all forms of institutional

financial assistance—need-based and merit-based aid. Before nationally aggregated data became available, some studies did demonstrate that merit aid to affluent students appeared to be increasing as investments in need-based aid were stagnant (Ehrenberg et al., 2005; Griffith, 2011). A fundamental attribution error occurs, however, when the conclusion is reached that merit aid directed at students without financial need is reducing institutional commitment to need-based aid. It simply is not. As college prices increase (see Table 1) and median household incomes are not increasing at a comparable rate, more college-bound students are eligible for and receiving need-based financial aid from HEIs. Table 1 indicates the growth in the costs of higher education since 1981 (National Center for Education Statistics, 2012). This point appears to be missing from nearly all of the coverage on merit aid in the popular press. More and more resources from HEIs are required to meet need-based financial aid in order to offset increasing costs that are unaffordable for a larger share of enrolled students over time.

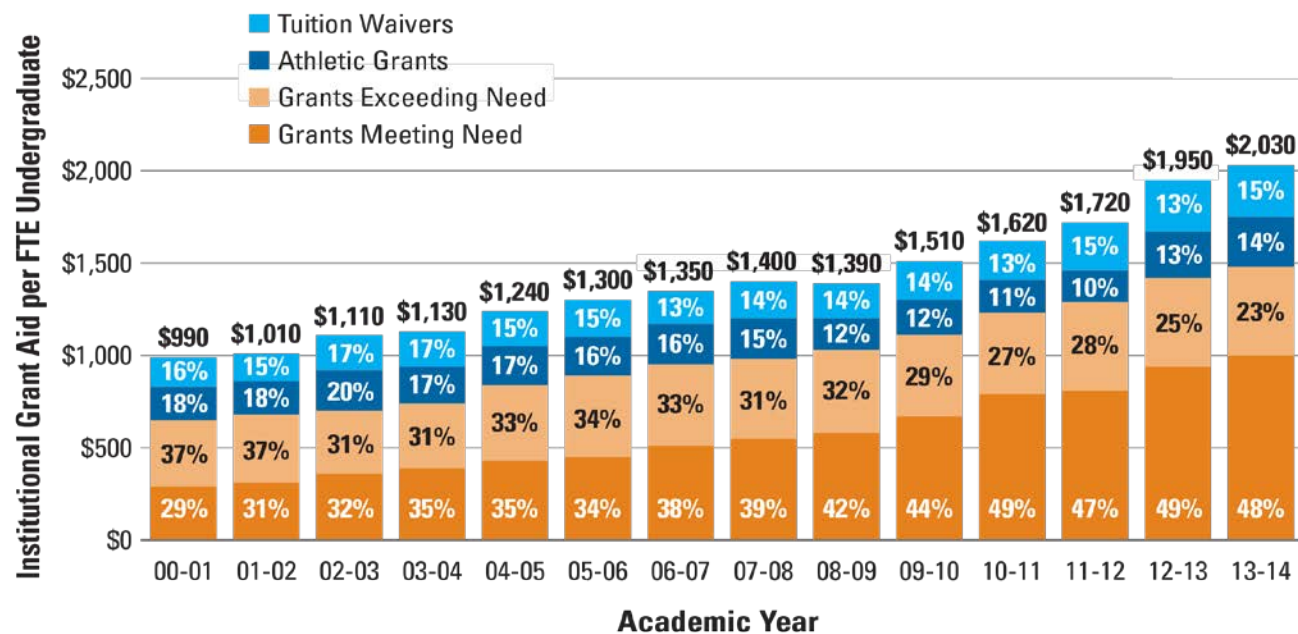
Related to growth in tuition prices and as illustrated in Figure 5, institutions are spending more on need-based aid as a percentage of all institutional grant assistance awarded (Baum et al., 2014). Interestingly, grants exceeding financial need represent a considerably smaller proportion of institutional grant aid today than they did fifteen years ago and institutional grant assistance to meet financial need represents a much higher share of total grant assistance than grants that exceed demonstrated need. Furthermore, HEIs are spending less (as a percentage of institutional grants awarded) on aid to students whose financial needs are already met (see Figure 6). Presumably, HEIs are attempting to increase net revenue through the use of merit aid as an enrollment incentive. One

could speculate that some of that additional revenue may be helping HEIs pay for the increasing costs of need-based financial aid.

As a predictor of enrollment. The value of merit aid as a predictor of student enrollment should be considered alongside the potential limitations of it that are identified in the popular press. How reliable is merit aid as a tool for helping an enrollment manager achieve targets associated with the composition of an entering class of students? What are the costs of merit aid to HEIs and the students they serve? Answers to these questions can provide a better-informed judgment about the potential trade-offs associated with institutional investments in merit aid. The skepticism of the popular press begs an additional question that is unanswered in the literature and could be explored in future studies. Can an institutional investment in merit aid directed toward high-achieving students from affluent families serve to generate additional revenue (i.e., “net tuition”) that *could* be used to increase need-based financial aid?

Average Institutional Grant Aid per Full-Time Equivalent (FTE) Undergraduate at Public Four-Year Institutions, in 2013 Dollars, 2000-01 to 2013-14

Public Four-Year



SOURCE: The College Board, *Trends in Student Aid 2014*, Figure 31A

For detailed data, visit: trends.collegeboard.org.

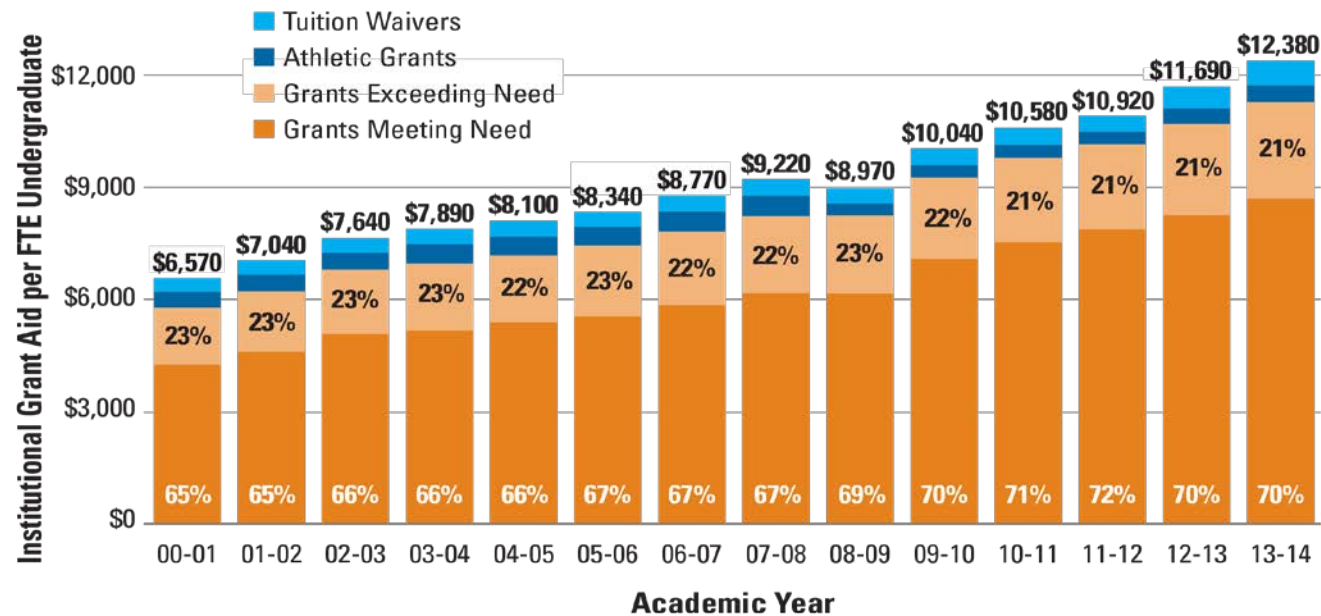
Trends in Student Aid 2014

CollegeBoard

Figure 5. Average institutional grant aid, publics: 2000-2013.

Average Institutional Grant Aid per Full-Time Equivalent (FTE) Undergraduate at Private Nonprofit Four-Year Institutions, in 2013 Dollars, 2000-01 to 2013-14

Private Nonprofit Four-Year



SOURCE: The College Board, *Trends in Student Aid 2014*, Figure 31B

For detailed data, visit: trends.collegeboard.org.

Trends in Student Aid 2014

CollegeBoard

Figure 6. Average institutional grant aid, privates: 2000-2013.

Table 1

Average Total Tuition, Fees, Room and Board Rates: 1981-82 to 2011-12.

Year and control of institution	Constant 2011–12 dollars ¹			Current dollars		
	All institutions	4-year institutions	2-year institutions	All institutions	4-year institutions	2-year institutions
Public institutions						
1981–82	\$6,439	\$6,942	\$5,378	\$2,663	\$2,871	\$2,224
1991–92	8,461	9,374	5,965	5,138	5,693	3,623
2001–02	10,244	11,744	6,561	8,022	9,196	5,137
2002–03	10,624	12,230	7,000	8,502	9,787	5,601
2003–04	11,308	13,053	7,352	9,247	10,674	6,012
2004–05	11,710	13,564	7,568	9,864	11,426	6,375
2005–06	11,955	13,847	7,424	10,454	12,108	6,492
2006–07	12,317	14,266	7,597	11,049	12,797	6,815
2007–08	12,440	14,435	7,498	11,573	13,429	6,975
2008–09	12,993	15,119	8,023	12,256	14,262	7,568
2009–10	13,443	15,764	8,088	12,804	15,014	7,703
2010–11	13,961	16,384	8,321	13,564	15,918	8,085
2011–12	14,292	16,789	8,561	14,292	16,789	8,561
Private not-for-profit and for-profit institutions						
1981–82	\$14,909	\$15,306	\$11,477	\$6,166	\$6,330	\$4,746
1991–92	22,874	23,476	15,860	13,892	14,258	9,632
2001–02	28,624	29,240	20,210	22,413	22,896	15,825
2002–03	29,166	29,725	22,185	22,413	22,896	15,825
2003–04	30,112	30,657	23,917	24,624	25,070	19,558
2004–05	30,648	31,174	24,096	25,817	26,260	20,297
2005–06	30,771	31,257	24,447	26,908	27,333	21,404
2006–07	31,703	32,237	22,611	28,439	28,919	20,284
2007–08	31,998	32,491	23,310	29,767	30,226	21,685
2008–09	32,656	33,154	24,093	30,804	31,273	22,726
2009–10	32,574	33,061	25,706	31,023	31,488	24,483
2010–11	32,964	33,572	24,570	32,026	32,617	23,871
2011–12	33,047	33,716	23,447	33,047	33,716	23,447

Implications for Public Policy

One incentive for this study was to inform perceptions of the general public and public officials who seem especially dubious of the practice of awarding merit aid to affluent students. In service to enrollment management strategy, merit aid can contribute

to more precise targeting of entering classes of students. As administrative policy and law makers consider how to respond to the breadth of criticisms levied against merit aid and yield prediction tactics, this study demonstrates the utility and importance of its retention.

Research Question

The study is intended to answer the question: Can the amount of merit aid awarded to an applicant for admission be used to reliably predict enrollment?

Summary of Methodology

To judge the influence of merit aid offers on enrollment yield, a binary logistic regression model was developed that included several independent variables. Merit aid, sex, race, ethnicity, State of residence, distance from home, college entrance examination scores, and financial aid application data were all included in a logistic regression model. The amount of merit aid offered to the student and the beta value associated with the merit aid variable represented the relationship between the amount of money offered and the likelihood to enroll. The other independent variables were controlled in order to isolate the impact of merit aid on enrollment. For the purpose of this study and because the goal was to isolate the impact of institutional grant aid on student enrollment, merit aid did not include State-based aid for which participants may have been eligible.

Limitations and Delimitations

Assessing similar institutions. One of the great strengths of higher education in the United States is the diversity of institutions available to college-bound students. However, the uniqueness of each institution makes comparisons complex. Even if the study of one set of institutions results in a conclusive finding, it is difficult to control for

the range of influences on all HEIs and the resulting choices made that could yield different results in a study of another set of institutions. Because institutional enrollment and financial aid practices are proprietary in nature and there is not a source of data that documents all of the nuance in those practices, confounds are both likely and hidden (e.g., market perceptions, the appeal of institutional commitments to diversity or particular religious traditions, variations in athletics programs and conferences, perception of alumni network or career outcomes). This study analyzed the data of three institutions that represent similar Carnegie classifications but with different market positions (i.e., the characteristics of their applicants). The institutions selected for the study are moderately selective in admission, exercise similar enrollment management practices, share the same Carnegie classification and control, and have relatively high cost and price structures for tuition, fees, room, and board.

Proprietary considerations. As stated earlier, it is difficult to gain access to reliable micro-level institutional data. Most colleges and universities consider conversion and yield rates as well as strategies involving the application of merit aid for various segments of their population to be information worth guarding from competitors. Many institutions do not analyze these micro-level data carefully or at all (Ruffalo Noel Levitz, 2016) and, as a result, are less concerned about the reliability of data that would be required to conduct this kind of analysis. Consequently, it is difficult to access larger sample sizes and populations for which reliable data exist.

Market position amongst other institutions. Although the number of HEIs to which students could direct their FAFSA results was accounted for in the study, the specific institutions and their related strengths of market position (where they fall in any

pecking order of institutional quality) were unaccounted for in the model. Ideally, it would be preferable to assess market position (or brand strength) of the institution offering merit aid against the brand strength of those institutions to which each of the students in the sample have also been offered admission.

Assumptions

It is assumed that the data collected and analyzed for the purpose of this study are complete and accurate. It is possible, due to data entry or coding errors made by those processing enrollment transactions at the participating institutions, that even a careful approach to the collection of these data did not produce entirely accurate results. Nevertheless, considerable caution and attention to the details contained in student records was observed.

Chapter 2: Literature Review

Summary

The student choice process is widely accepted as one that occurs in stages, beginning as early as the developmental years and continuing through high school and beyond. Research has generally 1) focused on the final stage (enrollment) of the student choice process, 2) identified a variety of variables found to be related to student enrollment choice, and 3) occurred prior to 2000 after which significant cost and price increases have been observed in higher education. Research that specifically focused on the impact of merit aid on the student choice process has typically been devoted to the role of merit aid in State-based programs designed to retain in-state residents, its impact on the enrollment of low-income students, and its influence on the characteristics and qualifications of entering classes of students. Institutional effects of merit aid have been examined closely in the literature. The impact of merit aid on enrollment decisions of college-bound students has less seldom been investigated. The use of merit aid by enrollment managers and their institutions has grown in popularity as a mechanism through which to achieve a variety of institutional and enrollment objectives, most notably goals associated with net student revenue. But merit aid has not been adequately examined as a predictor variable of enrollment yield on offers of admission. This study investigated the reliability of merit aid in projections of enrollment.

Theoretical Framework

The student choice literature. The scholarly literature on college student choice outlines a number of stages through which students pass in the process of discerning where to apply for admission and where to enroll. Some have suggested that there are as many as seven stages through which enrollment decisions are reached by college-bound students (Litten, 1987) although most researchers appear to focus on fewer stages. The frequently cited model for student choice developed by Hossler, Braxton, and Coppersmith (1989) outlined three stages beginning with the formation of college aspirations from early childhood through high school and leading up to their engagement with colleges that actively recruit them to apply for admission. The second stage includes the acquisition of information from a variety of sources about colleges of

possible interest. During this “search” stage, students take college entrance examinations that are required for admission at many accredited colleges and universities. At the time when they register for these exams, students may elect to have their scores sent to any number of colleges to which they may consider making application. In turn, colleges may communicate with prospective students about their academic, co-curricular, and extra-curricular programs. The second stage ends when students choose to apply for admission to one or more institutions of interest. The final “choice” stage includes announcements of admission by each of the colleges to which an applicant has applied, payment of a deposit or expression of intention to enroll, and attendance. It is during the choice stage of the process that students declare their intention to apply for financial aid and, with offers of financial aid (either need-based or merit-based) in hand, students and their influencers weigh options and choose to enroll at one of the colleges in their choice set (Hossler, Braxton, & Coppersmith, 1989). Several studies have focused on the choice stage of the college attendance process with an emphasis on predicting student behavior in choosing a college as a function of perceptions and preferences about the college and the individual characteristics of the student (Fuller, Manski, & Wise, 1982; Paulsen, 1990; Weiler, 1996). Results of these studies suggest that a range of factors are related to student choice (e.g., sex, race, family income, parents’ educational attainment, distance from home, academic ability and achievement, special programs, curriculum, selectivity, tuition and financial aid).

Although most of the studies on student choice relate to undergraduates, there are some that have examined the enrollment decisions of graduate students (Hearn, 1987; Kallio, 1995). Most studies performed on predictors of student enrollment were

conducted before significant price increases occurred in higher education. Even then, several evaluated the role of tuition and financial aid in the student choice process (Dynarski, 2000; Ehrenberg & Sherman, 1984; Heller, 1999; Kane, 1994; McPherson & Schapiro, 1991; Parker & Summers, 1993; St John, 1990). These studies focused primarily on the role of need-based financial aid and found that tuition, financial aid, and costs of attendance are all related to enrollment but, notably, that the size of the effect can vary substantially. Several researchers have identified a variety of factors that appear related to enrollment choices. Among them are studies that examined the race of the student (Ehrenberg & Sherman, 1984; Kane, 1994; Light & Strayer, 2000; McDonough, Antonio, & Horvat; McDonough, Lising, Walpole, & Perez, 1998; Tobias, 2002), income of the student's family (Dynarski, 2000; Ehrenberg & Sherman, 1984; Leslie & Brinkman, 1987, 1988; David M. Linsenmeier, Rosen, & Rouse, 2002; McPherson & Schapiro, 1991; St John, 1990; van der Klaauw, 2002), education of the student's parents (Keane, 2002), college sector and type (Heller, 1997), and whether the student is from in-state or out-of-state (B. Curs & Singell, 2002). To a lesser extent, scholars have examined the impact of merit aid on student choice. When the impact of merit aid on student choice has been examined, it is often done so as a factor analysis related to the enrollment of low-income students (Baum & Schwartz, 1988; Ehrenberg et al., 2005; Griffith, 2011; Heller, 2002; Heller, Marín, & Civil Rights, 2002). These studies have not always produced consistent findings about the influences on student enrollment. For example, race as a determinant of enrollment at historically black or predominantly white colleges varies depending upon the location, religious affiliation, social reputation, athletics, proximity to home and academic reputation (McDonough et al., 1998).

Influences on College Choice

Some studies have focused on the impact of institutional grants to meet student financial need on enrollment choices (Hurwitz, 2012; D. M. Linsenmeier, Rosen, & Rouse, 2006), and others have examined enrollment choices based upon fluctuations in tuition (Buss, Parker, & Rivenburg, 2004). Others have posited that student expectations of receiving financial aid even prior to applying for admission or financial aid influence student college choice and have used analytical tools to estimate expected financial aid in an effort to control for that “missing” variable in the sample set (DesJardins et al., 2006). Some have studied how students with unusually high academic qualifications react to actual offers of merit aid, student loans, and student work and whether and to what extent the educational level and institutional choices of their parents serve to inform their enrollment choices (Avery & Hoxby, 2004; Ehrenberg & Sherman, 1984). The Ehrenberg and Sherman study (1984) points to the possibility and importance of assessing “market equilibrium” to compare the costs and financial aid awards at competing institutions. Through a survey of admitted students, their study assessed the financial aid offers made to them by other institutions in the students’ competitive set of colleges. Through testing various propositions about the propensity for students to enroll, they concluded that in order to increase enrollment yield on offers of admission, it would make sense for Cornell to award more financial aid (effectively charging less) to the highest achieving admitted students and students of color since their propensity to enroll was lower. Subsequent statistical models have been utilized to compensate for the absence of information pertaining to the amount of financial aid offered to admitted students at HEIs in an effort to study the effect of financial aid on enrollment decisions

(van der Klaauw, 2002). These studies acknowledge the important role of market context in the student enrollment choice process and the monetary value of merit awards in the influence of enrollment choices. However, with the exception of the Avery and Hoxby study (2004) that focused on a few thousand students with high SAT averages and the Ehrenberg and Sherman study (1984), the literature is scant on studies that are specifically focused on the relationship of actual merit aid offers and enrollment yield.

Several things have likely contributed to the lack of research related to merit aid as a function of student enrollment at a particular HEI: the complexity of financial aid—how a student’s financial need is assessed and awarded; the nomenclature used in the financial aid industry to identify need-based versus merit-based financial aid; the variability in forms and types of financial aid across institutions; the proprietary nature of financial aid related strategies; and access to student records that are protected by privacy policies related to family financial records associated with the award of financial aid.

Studies that have examined the relationship of various independent variables to enrollment decisions have sometimes excluded the variable of merit-based financial aid entirely (Weiler, 1996). A recent study performed at Williams College (where only need-based financial aid is awarded) identified the significance of other variables that accounted for variance in enrollment yield on offers of admission. In particular, test scores, high school GPA, race, geographic origin, the student’s artistic ability, athletic and academic interests were all strong predictors of enrollment (Nurnberg, Schapiro, & Zimmerman, 2012).

Predicting Enrollment

A variety of challenges have emerged in recent years that complicate predictions of student enrollment. The ease with which college-bound students can use the Common Application to apply to multiple HEIs makes the chances of enrolling at an institution lower than when they applied to fewer HEIs. The removal by the National Association of College Admission Counseling (NACAC) of the frowned-upon practice of simply asking a student their rank-ordered preferences of HEIs (National Association of College Admission Counseling, 2014) eliminated an important predictive enrollment variable. The simplicity of submitting a FAFSA to apply for financial aid at as many schools as an applicant would like presents an additional confound for predictive enrollment models. Nonetheless, a wide variety of factors that influence college choice have been studied and provide useful information. Several models developed for predicting the enrollment behavior of students are reflected in the student choice literature and are outlined below.

Price and perceived quality. Thirty-five years ago, at the advent of financial aid leveraging, the influence of perceived quality of the college and net price were found to be important factors in the college selection process (Chapman, 1979; Hoenack & Weiler, 1979). It was determined that students preferred higher quality colleges where they could spend the least amount possible on the net price of enrollment. Chapman (1979) cautioned colleges to, “emphasize to admitted students that their school is of high quality and that students will be obtaining value for their dollar” pp. 54+55. He pointed out that both financial aid and the expected out-of-pocket costs relative to income both affected college choice behavior.

Distance from home and socioeconomic conditions. Qualitative study involving interviews of students in the 1980s led researchers to conclude that some chose colleges within close proximity to their homes, perhaps so that they could commute. The conclusion was also reached that as the academic performance of students and their family financial resources increased, the number of colleges they seriously considered increased (Hossler, Schmit, & Vesper, 1999).

Foregone earnings, student ability, and peer choices. One approach to college choice is the perception of a student to lose income during the college years by not instead entering the workforce. The extent to which a student was affected by the concern of foregone earnings was proportional to their self-perception of academic ability. If their academic credentials were strong, they were more likely to be enrolled in college, leading the researchers to conclude that the plausibility of earning more income after graduating from college than could be earned by not ever enrolling was greater for students who perceived themselves to be capable of success in college. It was also determined that the likelihood of students to pursue a particular post-secondary option was highly correlated with the percentage of classmates making similar choices (Fuller et al., 1982).

Psychological, sociological, and economical influences. Predicting college choice has been approached differently by academic discipline. Psychologists have emphasized the climate of an institution and its impact on a student's assessment of student-to-institution fit (Astin, 1965). Sociologists have perceived the college choice process within the framework of a general status attainment process linking the choice to expectations of attaining a new level of socioeconomic status, and economists have

sometimes viewed the college choice in the context of investment or decision-making behavior where a student's decision is influenced by what they believe will be possible for them economically if they attend a particular college. (Jackson, 1978; T. W. Schultz, 1961).

A range of influences. A variety of factors contribute toward college going choices. The roles of important others and institutional factors in the college choice process have been analyzed and found to be meaningful in the determination of enrollment (Paulsen, 1990). Although some of the literature on college choice is dated, there are strong suggestions of possible predictor variables that could be used by HEIs to determine if some of the variability in their enrollment yields can be explained by them. For example, at one time an institution could expect a higher yield rate on offers of admission when: the students to whom they offered admission were white rather than nonwhite (Jackson, 1978; Kane, 1994); the student was not married (Borus & Carpenter, 1984); family income was higher (St John, 1990); parents' educational attainment was higher (Kodde & Ritzen, 1988); father's occupational status was higher (Conklin & Dailey, 1981); high school achievement was higher (St John, 1990), admission selectivity was higher (Kohn, Manski, & Mundel, 1976) or both student achievement was higher and the college was more selective (Light & Strayer, 2000); and the student lived closer to campus (Leppel, 1993).

Tuition discounting effects on college choice. In more recent years, researchers have also given attention to the concept of tuition discounting and its role in targeting enrollment and have found that net price (the cost of attendance to the student after financial aid is applied) responsiveness decreases with financial need and ability. This

finding can be interpreted to mean that the higher the family income, the less responsive the student to offers of financial aid (B. R. Curs & Singell, 2010). Other studies have analyzed the impact of financial aid received and the timing of the financial aid announcements on the enrollment decision (DesJardins et al., 2006).

Scholarly work on merit aid. Studies of merit aid in relationship to student enrollment can be organized into five general categories: descriptive studies outlining the history and practice of tuition discounting through the application of merit aid; the impact of institutional investments in merit aid on need-based aid programs and low-income students; the enrollment outcomes of merit aid programs sponsored by various States; the relationship of merit aid to achieving institutional enrollment goals; and the far less often studied area of focus for this pursuit—the influence of merit aid on college choice. Although each of these approaches to the scholarly work related to merit aid is relevant to this study and was explored in the literature review for purposes of providing context, the primary focus was in the area where the least is known--the influence of merit aid on college choice.

Pioneers of merit aid research. Since financial aid leveraging began to gain popularity at private institutions in the 1980s, scholars have been speculating about its impact on HEIs and the students they serve (Heath & Tuckman, 1987; James, 1988). The focus of early scholarly work was on student enrollment patterns by socioeconomic status. From the outset, skepticism was directed toward merit aid because it was awarded to students who would presumably have enrolled in college without it. Given the limitations of operational budgets, it was argued that investments in merit aid were coming at the expense of institutional support for need-based financial aid. Early

researchers suggested that the chances of enrolling more academically qualified students through the use of merit aid (a claim often made by proponents) were empirically small and that, even when effective, would be short-lived (Baum & Schwartz, 1988). Studies were conducted that revealed the impact of net price (sticker price minus financial aid) on enrollment and persistence patterns and concluded that an increase in net price was correlated to a decrease in initial enrollment and persistence behaviors, especially among low income and underrepresented students (Glocker, 2011; Parker & Summers, 1993; Schwartz, 1985; M. L. Tierney, 1982; Wetzel, O'Toole, & Peterson, 1998).

When examining the impact of price considerations on enrollment patterns, researchers found that students who did not apply for need-based financial aid were much less sensitive to fluctuations in price (Avery & Hoxby, 2004; Moore, Stutenmund, & Slobko, 1991; M. L. Tierney, 1982). Described as a kind of “strategic maximization” of awarding limited institutional funds to students who, upon enrollment, would be revenue positive (contribute more in revenue than they would demand in financial aid and other institutional investments), the strategy of differential financial aid packaging has been acknowledged in the critical work of prominent higher education administrators (McPherson & Schapiro, 1998).

An analogy to describe merit aid. To describe financial aid leveraging, McPherson and Schapiro offered the analogy of selling seats on airplanes at a discount to consumers instead of insisting upon full price and having empty seats and no revenue when the costs of the flight will be nearly the same regardless of the number of seats filled. If a HEI has capacity it cannot fill by charging the full price of enrollment from those who could afford it, argue McPherson and Schapiro, offering a discount in the form

of merit aid to create an enrollment incentive is an understandable, if not prudent, practice. Especially in light of growing costs and diminishing revenue from State and Federal sources, these higher education economists certainly understood why the practice of financial aid leveraging had been adopted by many HEIs before the turn of the century.

Institutional Effects of Merit Aid and Tuition Discounting

State-based merit aid programs. Much of the literature on the effects of merit aid on student enrollment is dominated by the impact of State, regional, or city scholarship programs and their relationship to student enrollment choices (Bozick, Gonzalez, & Engberg, 2015; Dynarski, 2004; Ness & Tucker, 2008; Zhang, Hu, Sun, & Pu, 2016). Twenty-five states have adopted merit-based aid programs (Sjoquist & Winters, 2015). Many of these State-funded merit scholarship programs began in the mid-1990s (Woo & Choy, 2011). They were given names like the Promise Scholarship program (West Virginia), the Hope Scholarship program (Georgia), and the Bright Flight program (Missouri). These programs have been acknowledged in the research as having a positive impact on keeping students from crossing the borders of their home states (Orsuwan & Heck, 2009; Zhang et al., 2016). The programs appear to have a powerful influence on student enrollment choices leading some to conclude that students are willing to give up on the quality of a college for a relatively small scholarship (Cohodes & Goodman, 2014). Although State-funded merit scholarship programs have been effective in retaining in-state residents, their funding may not be secure. As cautioned previously (St. John & Parsons, 2004), “Higher education...is the largest broadly discretionary item in State general fund budgets, so it is the most vulnerable target for budget cutting” (p. 85).

Impact on low income students. Since the earliest scholarly pursuits, significant changes have occurred in higher education cost and subsidy structures and, consequently, the way some researchers have approached the topic of merit aid has also changed. With growing concerns about the costs of higher education, much of the literature is understandably devoted to the impact of merit aid on the enrollment of low income students. In a recent study of institutional changes that follow the adoption of a merit aid policy, it was discovered that an increase in the use of merit aid was associated with a decrease in enrollment of low income, underrepresented students (Griffith, 2011). This finding was particularly relevant at more selective institutions. The researcher posited that middle and bottom tier colleges may be offsetting their costs with tuition increases but that more selective institutions (which are often more expensive) require more student revenue than they can generate through reasonable increases in tuition, fees, room and board so they are under more pressure to enroll students who require less financial aid and generate more net revenue. Such an outcome represents the concern of several in the scholarly community who have been suspicious for several years that merit aid would ultimately compromise need-based financial aid programs.

Inflationary costs. The fact is that no other sector of goods and services in the United States approaches the high rate of growth in costs that are associated with higher education. As illustrated in Figure 7, when compared to growth in the general Consumer Price Index (100%) since the early 1980s, costs associated with medical care have risen 250%, as the Higher Education Price Index grew by nearly 450%. During that same period of time, median family income grew by 150% (Callan, 2008). The impact of these growing costs on the affordability of higher education among families across the socio-

economic spectrum are relevant to this study, especially as one considers the growing proportion of college-bound students whose families at one time would have had less difficulty financing their education and who now perceive themselves to have financial need that traditional needs-analysis processes fail to recognize. To the extent that merit aid serves to meet this felt need among those students whose families can contribute substantially to the costs of higher education, it represents an enrollment incentive.

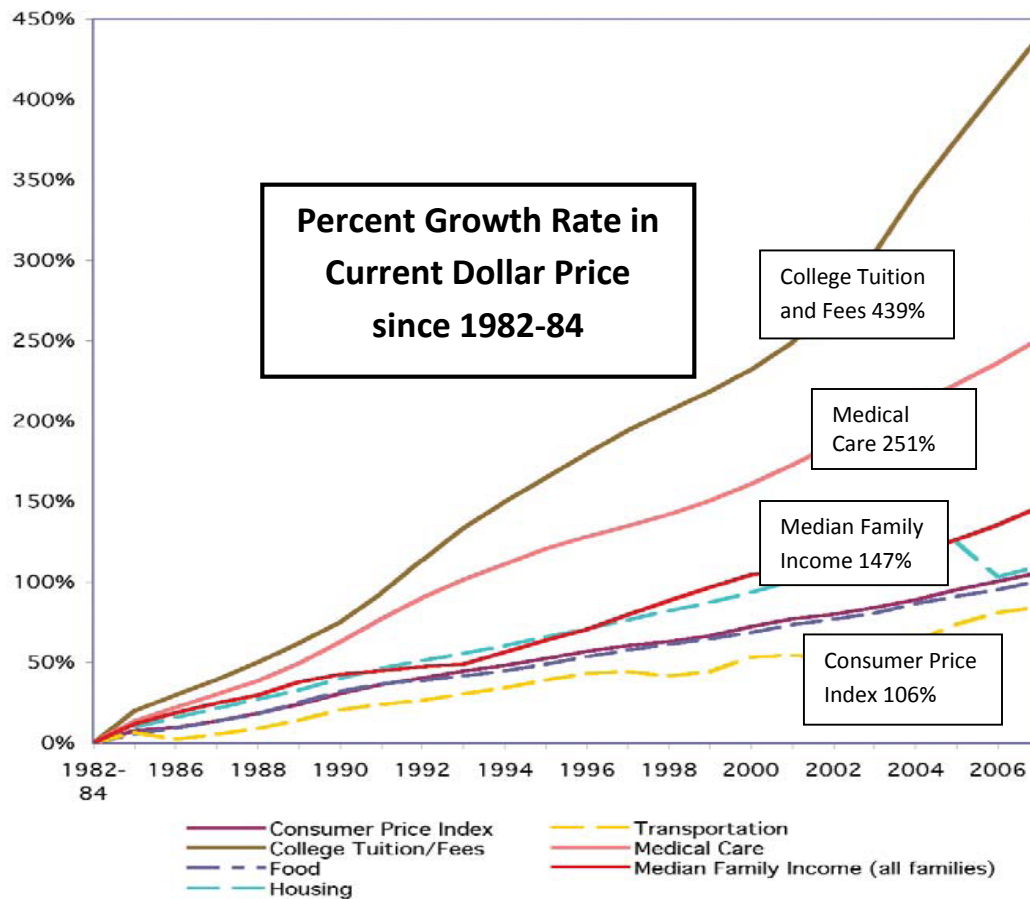


Figure 7. Percent growth rate in current dollar prices for goods and services as compared to higher education cost increases since the early 1980s.

This structural challenge in the cost and price equation for higher education is fundamental to the discussion of funding challenges for States, the Federal government,

and HEIs. It also has important implications for the affordability of higher education for college-going students and their families, especially those that do not have the resources HEIs increasingly seek from students and their families. Ultimately, it points to the need for HEIs to generate more student revenue than can be identified by enrolling too many students who cannot make such a contribution. One consequence of these converging factors is that merit aid is awarded to students who do not have demonstrated financial need, leading some to wonder how much demonstrated need in the United States could be met by a complete redistribution of merit aid from HEIs to need-based aid.

In 2009, when merit aid accounted for an average over-award (the amount of money awarded to a family beyond their demonstrated need) of \$3,083 in the United States, it was asserted that all demonstrated financial need would be met nationally if over-awards were unilaterally reallocated to meet that need (Mortenson, 2009a). Of course, unless such a strategy were imposed externally, it would be difficult to convince enrollment managers to abandon the use of merit aid when they realize or perceive a competitive advantage for their institution through the award of it. Market competition notwithstanding, Mortenson argues that institutional practices of over-awarding financial aid to students from families who don't need it to obtain a college degree come at the expense of creating challenges of access for low income students. Consequently, he advocates for the transference of higher education's merit-based scholarship programs to a completely need-based program (Mortenson, 2009b). With greater governmental appropriations and institutional dollars redirected to need-based aid, much or all of unmet need could be eliminated in the United States. But the removal of merit aid would create

significant challenges for enrollment managers who leverage financial aid to meet a variety of enrollment objectives.

Because so much is at stake for low income college-bound students, skepticism toward the decision of HEIs to award merit aid is understandable. When writing about tuition discounting, Baum and Lapovsky said, “References to tuition discounting frequently imply questionable motives on the part of colleges and universities that are viewed as manipulating prices in the interests of institutional priorities not necessarily consistent with the well-being of students” (Baum & Lapovsky, 2006).

What this perspective lacks is an acknowledgment that merit aid, if properly administered, may generate revenue that could underwrite the costs of need-based aid. Although on the surface it may appear that less of a commitment has been made to need-based aid by HEIs, without merit aid and the revenue it generates, investment in need-based aid programs might well have been less. It is possible that merit aid can generate revenue that ultimately serves to support institutional commitments to need-based aid.

Achieving Enrollment Goals

Academic profile. Strengthening the academic profile of an entering class is invoked as one reason for discounting tuition. Merit aid is often applied to the financial aid packages of the most affluent students who typically have strong academic credentials for admission. However, in a study by the Lumina Foundation it was determined that at 608 four-year private colleges and 266 four-year public institutions where discounting was practiced, higher average SAT Verbal scores were found at only 20% of those institutions between 1995-1999. Median scores at nearly half of these institutions *decreased* over the five-year period (Davis, 2003). In 2000, Redd found that schools

with the largest increases in discount rates did *not* increase the median SAT scores of their students. Nonetheless, merit awards may have been essential to enrolling the target number of students desired by the HEIs in the study and they may have served to ensure that average scores did not decrease.

Revenue generation: a mixed bag. Perhaps because of the limited and unstable financial aid data to which researchers have access, much of the literature that focuses on merit aid is aggregated across institutional control types. This makes it difficult to reach informed conclusions about the impact of merit aid on net student revenue. One consequence is that opponents of merit aid are suspicious of financial aid awarding practices generally without understanding the impact of merit aid when financial aid leveraging is methodically implemented at an individual institution. Tuition discounting does not always increase institutional revenue (Davis, 2003; Martin, 2002). If tuition discounts are more aggressive than the growth in the price of tuition, net tuition revenue grows more slowly and may even decline (Hillman, 2012). Some institutions with the most significant growth in discount rates have been shown to spend more on financial aid than they have received in net tuition revenue (Massa & Parker, 2007). But these results may be the consequence of an undisciplined financial aid leveraging strategy.

Although most institutions agree that care should be taken not to award unsustainable amounts of institutional resources to replace what families would otherwise be charged, a surprisingly low number of colleges and universities (fewer than twenty percent) concede to having what they would describe as an excellent enrollment plan that includes the strategic award of institutional aid (Noel Levitz, 2009). Unrestrained disbursement of institutional aid in service to enrollment goals of various kinds can place

HEIs in fiscal danger (Redd, 2000). Households cannot indefinitely sustain a practice of spending more than they earn; neither can colleges and universities. Among private colleges nationally, the average tuition discount rate in 2014 was 39.9 percent (Rufallo Noel Levitz, 2015). Unique cost and fee structures for colleges and universities make it difficult to generalize about an optimum level of tuition discounting for individual institutions. Nevertheless, most institutions understand that foregoing too much income could make it difficult to pay for instructional and non-instructional services required to maintain a high quality academic experience for students. A high discount rate can also compromise revenues required to underwrite the costs of need-based financial aid.

In 1998, McPherson and Shapiro illustrated the relationship of tuition discounting to the generation of net revenue. They found that institutions could manipulate financial aid offers to extract an optimal contribution from students toward net revenues and that sometimes the institutions pay too much to enroll the students they seek. Martin documented the erroneous assumption that enrollment growth increases net revenue by demonstrating that if tuition discounting is too high, it can have a negative net financial impact (Martin, 2002). He then articulated the advantages of average cost pricing over marginal cost pricing (Martin, 2004), ultimately arguing that the revenue from enrolling an additional student should always exceed the cost of enrolling that student (Martin, 2005). When the Board of Trustees announced the decision to close Sweet Briar College in 2015, reference was made to the mounting discount rates officials said were necessary to secure enrollment of the student body (Anderson & Svrluga, 2015). Implied in their announcement was weak market demand among prospective students, making it necessary to discount their price just to enroll an adequate number of students. These

represent reasons why some notable researchers are critical of tuition discounting.

Nevertheless, such a result is not necessarily a fait accompli of this institutional practice.

In 2012, Hillman discovered that once unfunded discounts (that is, unfunded by endowed or outside resources) exceed about 13% of tuition, institutions are at risk of diminishing returns. The implication is that discounting can lead to an increase in net student revenue but that care should be taken to ensure it isn't unregulated. Through a carefully crafted leveraging strategy, Dickinson College reduced their tuition discount rate from 50% to 30% and increased net tuition revenue. Dickinson's strategy demonstrated the possibility of generating greater revenue through careful management of institutional discount rates (Massa & Parker, 2007). This study in particular and the others that have focused on the various roles of tuition discounting have added to our understanding of the relationship between tuition discounting and net tuition revenue.

Gap in the Student Choice Literature

As compared to these earlier studies, the current study was uncharacteristically focused on the impact of merit aid on the enrollment decisions of students who did *not* have eligibility for need-based financial aid. Rather than focusing on the institutional effects of merit aid on low-income students, it examined the enrollment influence of merit aid on students to whom it was awarded—whose family resources were presumably adequate to accommodate the increasing prices associated with higher education.

More than any other research in a review of literature, the Avery and Hoxby study (2004) represents an authoritative and comprehensive analysis of factors that influence student college choices. The range of variables they tested removed considerable uncertainty from the complexity of decision-making by college-bound students. Their

study, however, tested a narrow band of the highest performing students nationally, focusing on those scoring at the 90th percentile on the SAT with average scores of 1357 out of 1600 possible points. Although their study, unlike several others in this review of literature, included a number of financial aid variables (e.g., merit aid, loans, work-study) it was not the focus of their study to assess how data from prior years related to offers of merit aid could be used to predict enrollment yield at the same institution in subsequent years. Their study assessed individual student decision-making and illustrated that merit aid does influence yield, but they were studying students who were quite likely to be admitted at HEIs that offer only need-based financial aid and no merit aid. Students from private high schools were also overrepresented in their study—students who receive a significant amount of college-going guidance from their school counselors.

Differences compared to other studies. The gap this study filled in the literature is primarily related to the predictability of enrollment yield based upon the amount of merit aid awarded. Given the wide variability in results observed at HEIs across the United States that try to bring classes in “on target” (2014) this study has the potential to help those institutions with limited enrollment capacity to fill--but not oversubscribe--their first year classes. Important differences of this study and those covered in the literature are: access to actual enrollment decisions reached by those students who were offered admission; the precise amount of merit aid (above their demonstrated need) that each student received; the information about other colleges of interest included on their FAFSA; and the official (not self-reported) academic qualifications of each admitted student (i.e., SAT scores). The econometric model developed predicts enrollment decisions based upon an extant data set. These data are not publically available.

As mentioned earlier, the Avery and Hoxby study (2004) did examine the impact of merit aid on enrollment decisions. They analyzed how a student *should* be expected to react to offers of financial aid versus how they actually reacted. For example, their study concluded that students were somehow more induced by offers of student loans and student employment than would have been expected given these less generous forms of financial aid. Their study also included an assessment of the extent to which the HEI's admission rate (the percentage of students offered admission from those that applied) influenced the enrollment behaviors of admitted students. Their study looked through the lens of human capital investment theory and included the effects of merit aid (and other forms of financial aid) on students in the top 10% of SAT score earners. High school students enrolled at private schools were overrepresented in the Avery and Hoxby study as 45% of the sample, compared to less than 10% of all high school students nationally (National Center for Education Statistics, 2016), were included. Their study focused on students admitted at the most selective institutions nationally. Notably, almost none of the most highly selective colleges nationally offer merit-based financial aid (Onink, 2015). As they pointed out (Avery & Hoxby, 2004), "...almost no systematic evidence exists on how high aptitude students respond to scholarships and aid..." (p. 4). Herein was a reason for exploring the topic of enrollment responses to merit aid more closely.

By contrast, this current study analyzed the effects of merit aid on student enrollment yield on offers of admission at moderately selective institutions where students who enroll have earned respectable *but not exclusive* results on college entrance exams. This study was intended to broaden the literature to include students who qualify for offers of merit aid but who are not exceptional enough to be admitted at the colleges

and universities included in the Avery and Hoxby study. This study included a more representative cross-section of students from public high schools across the United States (63%, 62%, and 77% respectively among the HEIs examined). It started with a question inherent in the sample of institutions selected for the study that instantly distinguished it from the Avery and Hoxby study: Can those responsible for managing enrollment at *moderately selective institutions* without such a strong brand identity utilize merit aid to achieve enrollment targets? If, as was demonstrated in this study, merit aid is positively related to enrollment yield, a carefully executed strategy to expend institutional resources on merit aid by colleges and universities that are less selective than those college destinations in the Avery and Hoxby study offers an important tool for their enrollment managers, the institutions they serve, and the students served by them.

Another important distinction between the Avery and Hoxby study and this one is that their study occurred in 1999-2000 when the average tuition at the institutions at which their subjects enrolled was less than \$18,000. The tuition at each of the institutions studied in 2013 and 2014 was over \$38,000. The sheer difference in price alone could be reason enough to study the effects of merit aid values again.

With access to 2,770 student aid records over two recent years at three similar private institutions with different market positions, this study examined the merit aid variable, controlling for academic credentials (i.e., SAT scores) and a variety of other financial aid application and student characteristics that could assist in the accurate prediction of enrollment yield. Unlike others revealed in the review of literature, this study benefited from the use of actual merit aid offers in the development of a model. It was not necessary to speculate about or estimate the value of merit aid offers.

Chapter 3: Methodology

Summary

The purpose of this study was to examine the relationship of merit aid to enrollment choice, controlling for academic qualifications (i.e., SAT scores), financial aid application information, and other student characteristics (e.g., sex, race, ethnicity, residency, distance of campus from home, options exercised by students for transmission of FAFSA data to institutions, and test optional admission election). Using econometric modeling as a framework for analysis, data were collected over a two-year period on the admitted students at three private colleges and universities in the United States. International and transfer students were eliminated from the sample as were students who applied for Early Decision because their application status already requires a binding enrollment commitment. The data set was further reduced to include only students whose financial need was verified through the submission of a FAFSA and who were ineligible to receive any need-based financial aid ($N = 2,770$). Separate logistic regression analyses were utilized to test the significance of each independent variable on the outcome variable of student enrollment at each of the three colleges. Those independent variables that did not account for a significant proportion of the variance were eliminated through a forward selection process to achieve parsimony. Results revealed a significant, positive relationship between merit aid and enrollment yield on offers of admission. Other significant predictor variables included information collected through the FAFSA.

Conceptual Framework

A number of studies referenced in the review of literature have been undertaken to assess the relationship of a variety of independent variables to undergraduate student enrollment decisions. The impact of financial aid on enrollment decisions has been studied extensively with considerable focus on the influence of need-based aid and State-sponsored merit aid on student enrollment patterns. Much of the literature related to merit aid includes a focus on the institutional effects of merit-based financial aid. This study was designed to isolate the relationship of merit aid to enrollment decisions controlling for a range of other variables as represented in Figure 8. There are a range of possible predictors of student enrollment. Certain key variables (i.e., merit aid, FAFSA data, and test scores) may account for a significant proportion of the variance in

enrollment decisions. As is common in social science research that examines human behavior (Mood, 2010), each of the studies that attempted to account for such variables inevitably excluded some factors that could influence student choice. Figure 8 acknowledges, through unlabeled variables, the omission of factors that could serve to influence enrollment choice. It identifies the dependent variable of enrollment decision and places it in the context of several independent variables this study was designed to investigate. Several key independent variables of interest are labeled and the size of the bubble with which they are associated reveals what a review of related literature might lead one to expect in terms of the proportion of variance accounted for by the respective independent variable.

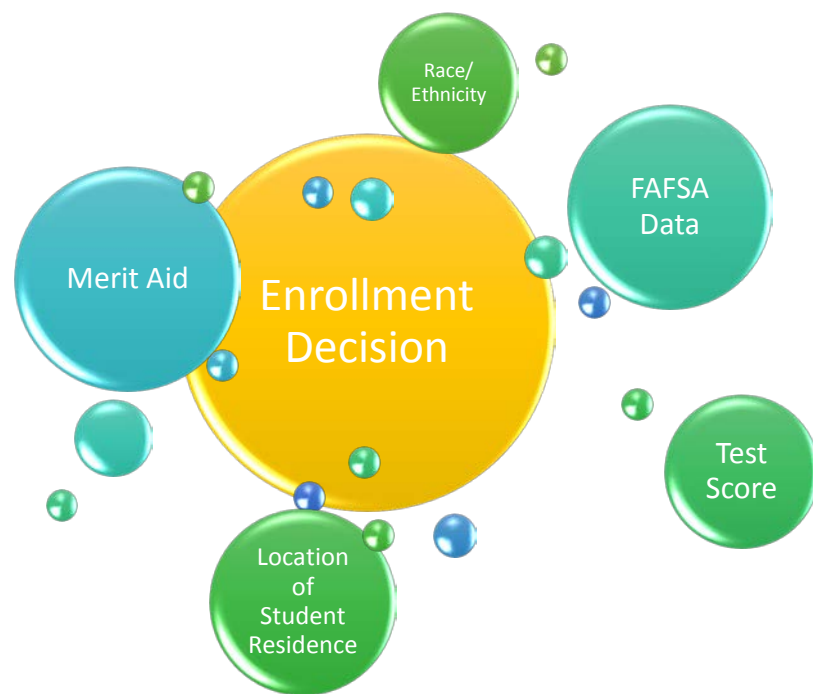


Figure 8. Probable predictors of enrollment yield.

Econometric modeling. This study was grounded in econometric modeling (Brooks, 1996). The econometric approach consists of three distinct phases: data

acquisition and verification; model estimation and validation, and model simulation and prediction (Intriligator, Bodkin, & Hsiao, 1978). In the first phase of this approach the amount of merit aid offered by each of three colleges and universities over a two-year period was verified. A model was developed for each of three HEIs in the study based upon the actual enrollment yields of admitted students. The models served as a statistical test of whether or not a particular characteristic or variable accounted for a significant proportion of the variance in predicting yield.

Hypothesis

- There is a significant positive relationship between the amount of merit aid offered to a student and that student's likelihood to enroll.

Research Design

Participants

Institutions and samples. The samples in this study were derived from the student bodies of three HEIs. The first is a private university in the South with an undergraduate enrollment of approximately 2,800 students, a SAT concordance (see description on page 73) interquartile range of 1090-1280, and an admit rate of 61% in 2014. The percentage of African Americans in 2014 equaled 8% and the student body was comprised of 14% Hispanics. The comprehensive fees of HEI #1 were between \$50,000-\$53,000 in 2013 and 2014. The second is a slightly smaller private university in the Southwest that in 2014 had an undergraduate enrollment of around 2,200 students, with a SAT interquartile range of 1210-1390, and an admit rate of 48%. The percentage of African Americans was 4% and Hispanics represented 18% of the student body in 2014. Comprehensive fees at HEI #2 were between \$45,000-\$48,000 in 2013 and 2014.

The third is a private liberal arts college located in the Midwest with an enrollment of around 1,650 students, a SAT concordance interquartile range of 1250-1430, and an admit rate of 28%. In 2014, the share of African Americans was 6% and Hispanics represented 8% of their student body. At HEI #3, the comprehensive annual fees were between \$53,000-\$57,000 in 2013 and 2014. For purposes of comparison and context, the average combined critical reading and mathematics SAT average score nationally in 2014 was 1010 (Bidwell, 2014). All of these institutions are relatively selective in admissions and, arguably, have a stable market position though none is exempt from competitive market forces affecting responsiveness to offers of merit aid.

Rationale for sample set. There are several reasons why these particular institutions were selected for this study. Each of them is a relatively small, privately controlled institution and charges the same amount for tuition, fees, room, and board to State residents and those that enroll from out of state. They each have relatively high tuition and offer merit aid to at least a portion of their admitted students. Their admission rates vary somewhat but place them all in a moderately selective admissions category. The enrollment management practices of these institutions are also similar.

Institutional isomorphism may be at work since the HEIs share a common relationship with the same enrollment management consultant who provides them with similar advice on recruitment strategies. The vice presidents for enrollment at these institutions attend and present at conferences together and often exchange ideas about enrollment management strategies. As such, similarities observed in enrollment yield may be less attributable to similarities in institutional control and size and partially explained by similar strategic enrollment management strategies. One reason for

selecting these three institutions from all possible alternatives is that they use strict and common data definitions in the description of financial aid and other admission related data so it was possible to confidently categorize students according to their application for financial aid, their financial need, and their status as someone ineligible to receive any need-based financial aid. It was also possible to know the admission status of each student. Publically available data do not reveal or account for the status of applicants for admission who decline offers of admission. Therefore, it would not have been possible to study other institutions without asking for information from HEIs about students who declined their offers of admission—a topic that is not often or easily engaged among competitors or even peers. Confidentiality observed by HEIs regarding application information may also contribute to the challenge researchers encounter when attempting to study data related to applications for admission and financial aid. Gaining access to applicant data may be especially challenging when attempting to acquire data from HEIs other than the ones at which researchers may happen to be employed.

It is important to note that a variety of distinctions between institutions may account for some of the difference in enrollment yield rates. In particular, the Avery and Hoxby study (2004) illustrated that admission selectivity is positively related to enrollment yield. That difference was unaccounted for in this study but is addressed in the discussion of the study in chapter 5 and recommended as an area for future study. The reasons for selecting these particular HEIs for this study notwithstanding, the selection of other institutions could have yielded different results. In fact, one way of addressing the possibility that different results may be observed with different HEIs was through the development of three separate models testing the same independent variables.

As the results revealed, the power of a particular variable to account for the variance in enrollment yield fluctuated from HEI to HEI. This underscores the importance of treating each HEI according to its unique conditions and market position when creating models to assess the influence of variables at individual HEIs. As described in the chapter on results, the merit aid variable is strongly related to enrollment decisions but it is not uniformly strong from HEI to HEI.

Student records. The study focused on students who were admitted at these three private higher education institutions for the entering classes of Fall 2013 and Fall 2014. The subjects were limited to students who directly entered college from high school, were from the United States, applied for financial aid and were judged as ineligible to receive any need-based financial assistance. Data were collected for the entire pool of admitted students at each of three institutions for 2013 and 2014. The data were harvested from three distinct computing sources at each institution. The Constituent Relationship Management (CRM) system at each of the HEIs in the study revealed the admission status of each possible student for the study and included college entrance examination scores (when available) and biographical information. Data from the FAFSA for all students in the analyses were also collected from the financial aid offices of these institutions. Finally, the financial aid awards of individual students were collected. These data revealed financial aid by source and included both merit and need-based aid from the HEIs as well as Federal and State aid. All files had unique student numerical identifiers which were used to merge the admission and biographical information with financial aid data. These three sources of data were then joined to create a comprehensive data set in SPSS of all three institutions. Of a total 20,842

students who were admitted to these institutions over the two-year period of the study, 2,770 met the criteria identified for inclusion. All others were omitted.

Omitted Records

Applicants eligible for need-based financial aid. Several variables were included in this study to determine the predictive value of merit aid on student enrollment. However, this study did not include an analysis of the impact need-based financial aid had on student enrollment. There is no doubt that need-based aid influences the extent to which a student and her family finds enrollment at a particular college affordable and attractive. The reality is that many students receive only need-based financial aid or some combination of merit and need-based financial aid. However, this study was intended to delineate the impact on enrollment of institutional dollars directed at students who received *merit aid only*. By isolating and studying only those in the sample population who did not qualify for need-based financial aid, it was possible to know with certainty that every dollar of institutional grant aid awarded would meet a strict definition of merit aid. It was also easier to determine the influence of merit aid on the accuracy of enrollment predictions. Nonetheless, by eliminating students with need-based eligibility for financial aid, the study did not include an important potential determinant for student enrollment for students with demonstrated financial need. As addressed in the review of literature, however, several studies have focused on the role of need-based financial aid on enrollment patterns of those who qualify to receive it.

Non-financial aid applicants. The records of more than 10,000 of the students who applied for admission to these HEIs in the two-year period of this study were eliminated because they did not submit an application for financial aid. One could

speculate that a decision not to apply for financial aid reveals doubt in their eligibility for need-based financial aid. The problem with that assumption is that just as many of them may not have been serious enough about the possibility of attending the HEI to which they applied to submit a financial aid application. To eliminate the significant risk that many of those students would have been eligible to receive need-based financial aid, their records were eliminated from this study. Elimination of these records was done uniformly with the data from all three HEIs in the study because the same criteria were used for inclusion in the study. After all, the purpose of the study was to test the influence of merit aid on students who were otherwise ineligible for need-based aid. However, since it is impossible to know which of the students who didn't submit a FAFSA would have been eligible for need-based aid, their records did not qualify for inclusion in the study. It is important to acknowledge that some of the records eliminated on this basis would have belonged to admitted students who, had they filed the FAFSA, could have qualified for inclusion in the study. Consequently, some upward bias may be reflected in merit aid coefficients due to the omission of these records (Lyles & Guo, 2009).

International students. Only domestic students were included in the study because international students do not file a FAFSA, the cultural norms around pursuit of a college degree are different for international students, and it would have been impossible to determine if those international students not submitting application materials for institutional financial aid would have been judged not to have financial need or to be approaching the HEIs with less seriousness than those who submitted an institutional financial aid application.

Redundant students. To address the possibility of the same student being represented in more than one of the applicant pools, the names of students were examined for cross comparison purposes. No student appeared in more than one of the applicant pools in either of the two years studied. To protect the identity of individual students and the proprietary interests of each institution, after the names were cross-referenced for duplication, they were all converted to a numeric identification code. The number of records that remained following the aforementioned extractions from the total were 2,770 for all three institutions over the two-year period.

Data Sources

Predictor variables in the study. The following independent variables were tested through logistic regression to determine if they significantly accounted for the variance in enrollment yield controlling for other variables:

Sex. When provided, this dichotomous variable was tested for significance.

Race. This variable was tested for African American or non-African American.

Ethnicity. This variable was tested for Hispanic or non-Hispanic.

Residency. Whether or not the student was considered an in-state resident for the purpose of admission was added to the model as a dichotomous variable.

Distance from home. This continuous variable was assessed in terms of the number of miles away between the students' residence and the institution.

The highest college entrance examination composite. This score was expressed through the SAT scale and, in cases where the highest ACT score earned was higher than the equivalent SAT score, was a converted score from ACT to SAT. The ACT/SAT Concordance Table was utilized for this purpose (The College Board, 2009).

FAFSA institutional choice order. This dummy variable indicates whether or not a student listed the institution being examined as the first HEI on their ordered list of colleges to which they have directed the results of their FAFSA application.

Number of institutional choices listed on FAFSA. In some cases, an applicant for financial aid applied to only one institution. Others applied to more than one institution. This dummy variable is related to submission of a FAFSA where only one institution (the one under examination) was identified by the student to receive the results of their financial aid application. It may be surmised that listing only one versus multiple HEIs on the FAFSA could account for a significant proportion of the variance explained.

Amount of institutional grant at each institution. This continuous variable represents the amount of merit aid awarded in excess of demonstrated financial need. For purposes of this study, merit aid did not include funding available from a State-based merit aid program. Such aid was only available to in-state residents at one of the HEIs included in the study and the students were eligible to receive that aid at any private HEI in that state. Because the records of students with demonstrated financial need were eliminated, only students receiving a merit aid award were included in the sample.

Test optional admission election. Some students were admitted under a program that does not require test scores. When a student did not submit a test score, one was imputed from the average score of those who elect test optional admission. A total of 129 students in the study were admitted without reference to their test scores and the average score imputed for their records was 980.

These independent variables are summarized in Table 2 below.

Table 2

Description of Independent Variables for Enrollment Yield

Variable Name	Variable Description	Range
Sex	Male or Female	Male = 1 Female = 0
Race	African American, Hispanic	African American = 1 Non-African American = 0
Ethnicity	Hispanic	Hispanic = 1 Non-Hispanic = 0
Residency	The residency of a student's family at the time of application for admission.	In-state residence = 1 Out-of-state residence = 0
Distance from Home	This continuous variable will be assessed in terms of the number of miles away between the students' residence and the institution.	0 to 6,736 miles
The Highest College Entrance Examination Composite	This score will be expressed through the SAT scale and will, in cases where the highest ACT score earned is higher than the equivalent SAT score, be a converted score from ACT to SAT.	400 - 1600
FAFSA Institutional Choice Order	Whether or not a student listed the institution being examined as the first HEI on their ordered list of colleges to which they have directed the results of their FAFSA.	Institution listed in first position = 1 institution is listed in any other position = 0
Number of institutional choices listed on FAFSA	Submission of a FAFSA where only one institution (the one under examination) has been identified by the student as the only HEI to receive the results of their financial aid application.	Only one institution to receive FAFSA results = 1 More than one institution is designated to receive FAFSA results = 0
Amount of institutional grant (merit aid) at each institution	A continuous variable represents the amount of merit aid awarded.	\$0 - \$39,800
Test optional admission election	Some students at these institutions were admitted under a program that does not require test scores.	Test optional admission = 1 Not test optional = 0

Although not every possible enrollment decision variable can be controlled for in the study (e.g., sports team allegiance, romantic partner influence on enrollment choice, preference for academic major at the moment of decision, parental influence), the sample size of the students helped mitigate the impact of random fluctuation in student decision-making behavior. Controlling for a robust set of independent variables demonstrated through prior research to account for a significant proportion of the variance explained in enrollment decisions also allows greater confidence in the relationship between merit aid and likelihood to enroll.

Integrity of Data

SAT concordance. A test score variable was created to represent student academic credentials. For those who provided ACT, their scores were converted to SAT utilizing concordance tables published by the College Board (The College Board, 2009). For those who submitted both an ACT and a SAT score, the higher of the converted ACT or the SAT tests were utilized in the study. All scores were expressed on an SAT scale. These scores were selected as a proxy for student academic qualifications because they represent a consistent measure across all high schools and are available for most students.

Treatment of missing data. One of the institutions in this study observes a test optional admission practice. Consequently, a small number of applicants in this study ($N = 129$) elected not to have their test scores examined in conjunction with their admission application. In spite of that choice, test scores for about one-half of the students at that institution are transmitted when the high school transcript is sent as part of the application file or by a previous test registration at which time the student identified the institution as one that should receive her scores. Although the scores are not used in the process of

examining the candidate for admission, because they are available, a value equivalent to the average of these scores was imputed and assigned to each student with a missing test score. When the selection criteria were applied, 2,770 students met the qualifications for the study. All of them have complete records.

Definitional differences among institutions. There is also the challenge of definitional differences among institutions. What one institution describes as need-based aid to an admitted student, another may describe as merit aid. An important distinction often made in the financial aid industry is that any institutional financial aid awarded that exceeds the amount required to meet the demonstrated financial need of the admitted student is referred to as “financial aid above need.” In this study, only those admitted students who were ineligible for need-based financial aid were included. In this way, it was possible to isolate only the effect of true merit aid (as opposed to aid that has a meritorious name but is packaged to meet financial need) on enrollment decisions. Nationally available databases that provide reliable enrollment and financial aid data are imprecise about the form and function of institutional aid. Often, that is explained by the lack of domain specific expertise on the part of institutional researchers compiling the data for HEIs. Although there are ample data that reveal the numbers and percentages of enrolled students eligible to receive the Pell Grant, various forms of institutional aid are concealed behind labels that are less specific (e.g., a Presidential Scholarship might be used to help meet demonstrated financial need at one institution but be comprised of purely merit aid at another).

Confidentiality of student data. Additionally, financial aid data are protected by legal standards outlined in the Family Educational Rights and Privacy Act (FERPA) of

1974. The records that are produced in conjunction with the application and award of financial aid within a financial aid office are considered educational records that may not be disclosed without the consent of an individual student. The list of protected records is long and includes: eligibility for Federal student aid funds; student account information; payroll records; applications for financial aid; student aid reports generated through the FAFSA; or any other materials received from the student and/or parents. Only the records related directly to an individual student are legally protected by FERPA (Ramirez, 2009). Institutions are required to report aggregated data but these reports suffer from the lack of specificity and integrity issues referenced above.

Domain expertise. To rigorously quantify institutional financial aid requires expert understanding of financial aid concepts and knowledge of an individual institution's financial aid needs analysis practices, financial aid packaging policies, and data storage and retrieval systems. Furthermore, it requires access to data that are typically regarded as proprietary in nature. Fortunately, for the purposes of this study, it was possible to access dependable, proprietary data of three different institutions and keep the institutions' identity confidential. This carefully controlled collection and use of data is essential to achieving reliable results.

Data coding considerations. The collection of enrollment and financial aid data necessary for a reliable assessment of the effects of merit aid on net student revenue is complicated by several factors. Among them are: computer software changes that make it difficult to compare historical with current data; definitional differences associated with data from original versus new data systems or warehouses; alteration of definitions of underlying concepts (e.g., changing an institutional definition of financial need when a

new needs analysis system is adopted or when financial aid policies change); modified procedures or approaches to entering original data; confusion over the dates when data were entered (i.e., as-of-June or as-of-October); inconsistency in the way matriculant and non-matriculant data are entered; and insufficient care in the accuracy of the underlying information during data entry. A benefit of this analysis is that these data challenges were all addressed through a common set of reporting standards agreed upon by the vice presidents for enrollment the vendor each of them have shared for the past five years and who has organized the institutional data in a consistent and uniform manner.

Limitations related to data accuracy. Data concerns go beyond questions of accuracy and completeness. Financial aid and admission offices maintain databases to satisfy their own needs and purposes which may or may not coincide with the needs and purposes of others, such as institutional researchers or faculty members. Different administrative agendas imply different ways of looking at the data that may or may not be consistent with the way in which the data are currently collected, entered, or maintained. Even under ideal circumstances when balance is achieved among the competing needs of the different interest groups at a specific point in time, administrative prerogatives and personnel changes can result in the loss or reformulation of data to meet new institutional needs. Even the well-intended institutional researcher is susceptible to the volatility of institutional change and the corruption of data that sometimes results. Unintentionally and as a result of heavy workloads, those charged with demanding operational objectives in financial aid and admission offices are often unconcerned with establishing, maintaining, and updating data definitions upon which institutional researchers depend for accuracy of reporting (Brooks, 1996). In this study, these

concerns were mitigated by the common approach the three vice presidents have taken to the agreed upon collection and transmittal standards of data that they each send to a common vendor every year.

Analysis

Statistical technique and variable assessment. Logistic regression is often chosen when the dependent variable is binary (i.e., the student either enrolled or did not enroll) and when the predictor variables are a mix of categorical and continuous variables (Wuensch, 2012). In this study, sex (male or female), race (African American or not), ethnicity (Hispanic or not), residency (in-state or out-of-state), FAFSA institutional choice order (listed the institution examined first or not, among more than one institution listed), number of institutional choices listed on the FAFSA (listed only the institution examined or more than one institution), and test optional admission election (elected to have their scores considered for admission or not) were each categorical variables. Distance from home (a range of miles), the highest college entrance examination composite (a range of scores), and amount of institutional grant (merit aid) offered (a range of merit aid awards) represented continuous variables.

Binary logistic regression was the statistical technique chosen for this study because it could be used to determine how much variance is explained on the dichotomous dependent variable of enrollment by a set of independent variables (Wuensch, 2012). The purpose of the study was to determine which of the independent variables accounted for a significant share of the variance in enrollment with a focus on the power of the merit aid variable. Binary logistic regression is estimated using Maximum Likelihood Estimation (MLE), which is a procedure that begins with a guess

of the best weight associated with each predictor variable or coefficient in the model. Coefficients associated with the independent variables are then adjusted as often as necessary until there is no additional improvement in the ability to predict the value of the dependent variable (Wuensch, 2012). This method facilitates the determination of variables related to student enrollment and also estimates the magnitude of the overall effect of the predictor variables on enrollment. A logistic model predicts the logit of Y from a variety of predictor X 's, where the logit is the natural logarithm (\ln) of the odds of Y occurring compared to not occurring. Because odds ratios are the probabilities (π) of Y happening (i.e., a student enrolling or not enrolling) then $1 - \pi$ is equal to the probability of Y not happening. The odds are defined as the probability that a particular outcome occurs divided by the probability that it does not (Hosmer, Lemeshow, & Sturdivant, 2013). The logistic regression equation is expressed as follows:

$$\text{logit}(Y) = \ln\left(\frac{\pi}{1-\pi}\right) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_i X_i + e.$$

The constant (α) is the Y intercept and β is the regression coefficient for each variable (X) and e is the error term (Cabrera, 1994; Peng, Lee, & Ingersoll, 2002).

Descriptive Statistics

Descriptive statistical information were provided for each of the three institutions as outlined in the general SPSS output. In particular, the amount and range of merit aid offered at each HEI. Test score differences and rates of admission at each of the three HEIs were also noted. Differences in the share of admitted students who were in-state residents and choices related to where to direct FAFSA results were also explored.

Building the Logistic Regression Model

A logistic regression analysis was conducted to determine the effects of sex, race, ethnicity, residency, distance from home, the highest college entrance examination composite, FAFSA institutional choice order, number of institutional choices listed on the FAFSA, amount of institutional grant (merit aid) offered, and test optional admission election at three institutions on the likelihood of admitted students to enroll. This technique is used to predict the odds of occurrence based upon the values of independent variables. One benefit of this technique is that it allows the likelihood of an outcome to be expressed by the percentage chance that it will occur. In this study, the occurrence of enrollment was being predicted based upon a specific offer of an amount of merit aid. With binary logistic regression, several independent variables were controlled in order to isolate the effect of a merit aid offer on the likelihood of enrollment.

Tests of models and variables. The chi-square statistic was used to evaluate the significance of the model and overall model fit (Wuensch, 2012). The -2 log likelihood ratio is a test of significance of the difference between the likelihood ratio (-2 log likelihood) for a model with predictors minus the likelihood ratio for the baseline model with only the constant in it (Burns & Burns, 2008). The smaller the statistic, the better the model (Wuensch, 2012). This was also used as a test of model strength. Because logistic regression does not offer an R-squared equivalent to linear regression (Hosmer et al., 2013), pseudo R-squareds were used to account for the percentage of variance associated with each variable being explained by the model. The Cox and Snell R^2 can be interpreted like R^2 in multiple regression but cannot reach a maximum value of 1. It tries to imitate multiple R-squared based on “likelihood,” but it is often less than 1

making it difficult to interpret. The Nagelkerke R^2 can reach a maximum of 1 and is viewed as a more reliable measure of how much variability can be explained by a logistic regression model (Burns & Burns, 2008). Consequently, Nagelkerke R^2 was utilized to report results. These pseudo R^2 statistics are regarded with caution by some researchers (UCLA, 2005). SPSS also provided outputs that identify the percentage of events (enrollment) and non-events (non-enrollment) predicted correctly. These are the predicted values of the dependent variable based on the full logistic regression model. It shows how many cases are correctly predicted and how many cases are not correctly predicted.

A forward stepwise conditional method (sometimes referred to as a forward selection process) was employed which assessed all independent variables, putting them in one at a time starting with the one that provided the most power to the model. The second most powerful predictor was added and so on until one of the variables was found not to account for a significant proportion of the variance explained. To achieve parsimony for the predictors considered, those independent variables that did not significantly (at the $p = .05$ level) account for the variance explained in each model were eliminated through the forward selection process. Forward selection is not the only statistical technique one may use to assess the predictive power of independent variables. It may not even be the most reliable although tests of alternatives have demonstrated that some techniques may be only modestly better and preferred in cases where prediction is not the only objective for the model (Bursac, Gauss, Williams, & Hosmer, 2008). However, the forward selection technique has been retained by SPSS as a valid procedure and, since prediction was the focus of this study, it was chosen. The statistical output in

SPSS produced beta coefficients for each independent variable. The beta weights demonstrated the strength and direction of the relationship between independent variables and the dependent variable. The weights associated with merit aid, the variable of greatest interest in this study, were interpreted as an estimate of impact of merit aid on the enrollment decision.

The logistical regression procedure produced a Wald statistic for each variable. This statistic was a test of the unique contribution of each independent variable to the enrollment outcome, holding constant the other variables and eliminating overlap between them (Burns & Burns, 2008). Log odds were used for interpretation of the impact of continuous variables on the likelihood to enroll and the exponentiations of log odds when converted to odds ratios were used to interpret the impact of dichotomous variables on the likelihood to enroll (Hosmer Jr & Lemeshow, 2004).

Using the model to predict enrollment. Utilizing the predictive power of the merit aid award variable while controlling for other variables in the model, a simulation was produced that illustrates the likelihood of enrollment yield based upon a specific amount of merit aid offered at each of the three HEIs in the study. Both a table illustrating the simulations and a chart showing the relationship between merit aid awards and enrollment yield are presented.

Assumptions of logistic regression. Several assumptions associated with the use of logistic regression are made in studies that deploy this methodology. Specifically, logistic regression does not assume a linear relationship between the dependent and independent variables, the dependent variable must be dichotomous, the independent variables need not be interval, nor normally distributed, nor linearly related, nor of equal

variance within each group, the categories (groups) must be mutually exclusive and exhaustive; a case can only be in one group and every case must be a member of one of the groups, and larger samples are needed than for linear regression because maximum likelihood coefficients are large sample estimates. A minimum of 50 cases per predictor is recommended (Burns & Burns, 2008). These assumptions were each tested in conjunction with this study and were all satisfied.

To test the assumption that the relationship between merit aid and enrollment continues in a linear fashion (the more the merit aid, the higher the likelihood of enrollment), a quadratic term was introduced. The variable of merit aid was squared and added to the model to test for significance.

Limitations

Omitted Variable Bias. Not all variables can be accessed or assessed in a manner that removes the possibility of Omitted Variable Bias in logistic regression. In reality, there are a variety of forces that contribute to a student's decision to attend a particular college or university, several of which are difficult to measure. Among those influencers are: the impact of important influencers in the student's life (e.g., parents and coaches); their perception of a college or university; the campus visit experience; and the legacy status—being the offspring of an alumnus of the HEI—of the applicant (Eagan et al., 2016; Erdmann, 1983).

Such circumstances help to explain the reason why some students choose to enroll at a particular institution even when there is no gap between what is being charged and what is affordable to the student. This is also why the model developed in conjunction with this study uses *probabilities* of enrollment and does not seek to establish causality

between merit awards and enrollment decisions. Nevertheless, the challenge with Omitted Variable Bias is well-documented in the literature. Using research design in place of control variables is a technique advocated for in the earliest work of econometric modeling (Hanushek & Jackson, 1977). This involves using careful sample stratification to address unmeasured effects. It also includes the careful choice of a research hypothesis (Freedman, 1991). In the case of this study, the hypothesis simply suggests the presence of a strong, positive relationship between merit aid and student enrollment. Finally, as indicated in *The Phantom Menace: Omitted Variable Bias in Econometric Research* (Clarke, 2005):

- It is impossible to include all the relevant variables in a regression equation;
- Omitted Variable Bias is therefore unavoidable;
- The inclusion of a subset of relevant control variables may not ameliorate, and may increase, the bias caused by omitted variables;
- The inclusion of a subset of relevant control variables may also cause additional bias through measurement error;
- Experimental control can, however, be achieved through careful research design (pg. 353).

To illustrate the potential effect of an omitted variable, it may be useful to consider the example of a variable that was not accessible for this study—legacy status. In this context, legacy refers to a student with at least one parent who attended the specific HEI in question. Were such designations available, a dichotomous variable could have been added to the model allowing for an examination of the effect of merit aid on enrollment controlling for legacy status. Given what was learned from prior studies

about the relationship of legacy status to enrollment (Avery & Hoxby, 2004), one might have expected the inclusion of this variable to decrease the coefficient associated with merit aid (i.e., the higher the odds of enrollment associated with being a legacy applicant, the lower the coefficient associated with merit aid). Consequently, by not including legacy status in the models, one could speculate that the coefficients associated with merit aid were upwardly biased; the merit aid coefficients are likely to be higher than they would have been if legacy status had been included in the models.

It is important to note that although minority students who met the requirements for inclusion in the study were small in number, prior research demonstrated that they respond differently to offers of merit aid (Ness & Tucker, 2008). An interaction variable that could account for variability in enrollment rates based upon merit aid awarded to minority students was not included in this study and would be appropriate to include in future studies, especially those in which the number of underrepresented minorities comprise a critical mass of the samples included.

Chapter 4: Results

Summary

The binary logistic regression models estimated for the three institutions in this study revealed some consistent independent variables that contribute to the predictability of student enrollment. When tested with a chi-square goodness of fit statistic, each of the models was significant at the p level of .001. When assessed with a Wald statistic for individual contributions to the predictive model, merit aid, the rank order of a HEI on the FAFSA, and whether or not a student elected to send the FAFSA results to one or more institutions accounted for a significant proportion of the variance explained. Additional variables that added to the proportion of variance explained included high test score composite and test optional election. Differences in the effect size of variables by institution and test scores were observed. Sex, race, ethnicity, in-state residency, and distance from home did not significantly account for the variance in any of the models and were eliminated through the forward selection process. The data in each model reasonably approximated a normal distribution curve.

Descriptive Statistics

Descriptive statistical information was provided for each of the three institutions as outlined in Table 3. Of note, considerably more merit aid was offered on average (\$20,074) at HEI #1 than either of the other institutions (\$16,200 and \$15,279, respectively). Of the three HEIs, the one with the most expensive cost of attendance (HEI #3) awarded the lowest overall maximum award in spite of having the highest overall test score average. On average, students in the sample who were offered admission at HEI #3 lived nearly twice as far from campus as did students offered admission at HEI #1 and HEI #2. Students in the sample who were offered admission at HEI #1 and HEI #2 were far more likely to be in-state residents (65% and 60%, respectively) as compared to students in the sample at HEI #3 who lived in-state only 5% of the time. Students in the sample at HEI #1 were almost two times as likely to list only that institution on their FAFSAs as compared to students at HEI #2 and HEI #3.

Table 3

Binary Logistic Regression Analysis Predicting Enrollment, Descriptive Statistics

	N	Mean	Standard Deviation	Minimum	Maximum
HEI #1					
Merit Award	1255	20073.5467	5766.2059	0.00	55000.00
High Test Score Composite	1255	1191.9490	155.4821	730.00	1600.00
Sex (Male)	1255	0.4510	0.4978	0.00	1.00
Race (African American)	1255	0.0215	0.1452	0.00	1.00
Ethnicity (Hispanic)	1255	0.0199	0.1398	0.00	1.00
Distance from Home	1255	408.3690	516.5063	2.55	5699.89
Residency (In-state)	1255	0.6470	0.4781	0.00	1.00
FAFSA Position	1255	0.3028	0.4596	0.00	1.00
FAFSA Count	1255	0.0876	0.2829	0.00	1.00
Test Optional Election	1255	0.1028	0.3038	0.00	1.00
HEI #2					
Merit Award	974	16199.8953	7295.8220	0.00	57928.00
High Test Score Composite	974	1323.2752	126.1936	1000.00	1600.00
Sex (Male)	974	0.4487	0.4976	0.00	1.00
Race (African American)	974	0.0298	0.1701	0.00	1.00
Ethnicity (Hispanic)	974	0.0493	0.2166	0.00	1.00
Distance from Home	974	536.8564	638.5588	0.00	6735.99
Residency (In-state)	974	0.6037	0.4894	0.00	1.00
FAFSA Position	974	0.1817	0.3858	0.00	1.00
FAFSA Count	974	0.0380	0.1913	0.00	1.00
HEI #3					
Merit Award	541	15279.1811	7818.6050	0.00	45217.00
High Test Score Composite	541	1448.2255	101.5755	1120.00	1600.00
Sex (Male)	541	0.4510	0.4981	0.00	1.00
Race (African American)	541	0.0203	0.1413	0.00	1.00
Ethnicity (Hispanic)	541	0.0166	0.0128	0.00	1.00
Distance from Home	541	995.5636	890.5226	44.88	6367.83
Residency (In-state)	541	0.0536	0.2254	0.00	1.00
FAFSA Position	541	0.1701	0.3760	0.00	1.00
FAFSA Count	541	0.0518	0.2217	0.00	1.00

Inferential Statistics

Basic enrollment yield statistics at these institutions indicate the overall likelihood of enrollment without accounting for any of the variability in yield. Given the basic enrollment yield rates ($266/1255 = 21\%$ enrolled at HEI #1; $221/974 = 23\%$ enrolled at HEI #2; $118/541 = 22\%$ enrolled at HEI #3), and no other information, a reasonable guess would be that no one would ever enroll. That strategy would be accurate 100% of the time when students did not enroll but 0% when the students did enroll. One purpose for building the logistic regression model is to improve the accuracy of enrollment yield predictions beyond what a simple guess provides. Ideally, the model would allow for improvement in yield prediction accuracy for students who choose to enroll.

The chi-square statistic is commonly used to evaluate overall model fit (Wuensch, 2012). For example, the chi-square value in the first model was 460.9 with five degrees of freedom and the resulting p value was less than .001. The chi-square statistic in the second model was 135.430 with four degrees of freedom and in the third model was 77.785 with three degrees of freedom, both with p values of less than .001. Each of the models were statistically significant based upon the model chi-square statistic.

The -2 log likelihood ratio is a test of significance of the difference between the likelihood ratio (-2 log likelihood) for a model with predictors minus the likelihood ratio for the baseline model with only the constant in it (Burns & Burns, 2008). The smaller the statistic, the better the model (Wuensch, 2012). As evident from Tables 4, 5, and 6, in all three cases the model summaries reveal that the -2 Log Likelihood statistics reduced with each step in the Forward Stepwise Conditional method suggesting strong models. In step 1 of the regression for HEI #1, the -2 Log Likelihood statistic was

Table 4

SPSS Model Summary Output, HEI #1

Model Summary			
Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	1006.572 ^a	.206	.320
2	892.931 ^a	.275	.427
3	856.882 ^a	.296	.459
4	840.373 ^a	.305	.473
5	835.567 ^a	.307	.477

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Table 5

SPSS Model Summary Output, HEI #2

Model Summary			
Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	957.586 ^a	.084	.128
2	926.835 ^b	.113	.171
3	921.834 ^b	.117	.178
4	907.729 ^b	.130	.197

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

b. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Table 6

SPSS Model Summary Output, HEI #3

Model Summary			
Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	511.614 ^a	.098	.151
2	493.872 ^a	.127	.196
3	489.737 ^b	.134	.206

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

b. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

1006.572 but by step 5 was 835.567. With the HEI #2 model, the -2 Log Likelihood statistic began at 957.586 and after Step 4 was at 907.729. At HEI #3, the -2 Log Likelihood statistic at step 1 was 511.614 and 489.737 by step 3. In each case, it was concluded that the addition of all variables in the models strengthened the fit.

As indicated earlier, the Nagelkerke R^2 can reach a maximum of 1, is therefore easier to interpret, and is viewed as a more reliable measure of how much variability can be explained by a logistic regression model than the Cox & Snell R^2 (Burns & Burns, 2008). Consequently, Nagelkerke R^2 was utilized to report results. These pseudo R^2 statistics are regarded with caution by some researchers (UCLA, 2005). As revealed in Tables 4, 5, and 6, the Nagelkerke R^2 estimated for HEI #1 was .477, for HEI #2 was .197 and for HEI #3 was .206. These account for the percentages of variance being explained by the models.

As shown in the Block 1 Classification Tables (see Tables 7, 8, and 9), the models improved the accuracy of the predicted enrollment decisions. At HEI #1 the model increased the accuracy of the enrollment prediction for when a student would enroll from 0% to 71% and decreased the accuracy of the prediction of non-enrollment from 100% to 85%. At HEI #2 the model increased the accuracy of the enrollment prediction for when a student would enroll from 0% to 44% and decreased the accuracy of the prediction of non-enrollment from 100% to 85%. At HEI #3 the model increased the accuracy of the enrollment prediction for when a student would enroll from 0% to 42% and decreased the accuracy of the prediction of non-enrollment from 100% to 90%.

Table 7

SPSS Classification Table Output, HEI #1

Classification Table ^a					
Observed			Predicted		
			matric		Percentage Correct
			0	1	
Step 1	matric	0	980	9	99.1
		1	165	101	38.0
	Overall Percentage				86.1
Step 2	matric	0	807	182	81.6
		1	68	198	74.4
	Overall Percentage				80.1
Step 3	matric	0	834	155	84.3
		1	75	191	71.8
	Overall Percentage				81.7
Step 4	matric	0	839	150	84.8
		1	76	190	71.4
	Overall Percentage				82.0
Step 5	matric	0	843	146	85.2
		1	78	188	70.7
	Overall Percentage				82.2
The cut value is .250, 0 = non-enrollment, 1 = enrollment.					

Table 8

SPSS Classification Table Output, HEI #2

Classification Table ^a					
Observed			Predicted		
			matric		Percentage Correct
			0	1	
Step 1	matric	0	666	87	88.4
		1	131	90	40.7
	Overall Percentage				77.6
Step 2	matric	0	666	87	88.4
		1	131	90	40.7
	Overall Percentage				77.6
Step 3	matric	0	665	88	88.3
		1	130	91	41.2
	Overall Percentage				77.6
Step 4	matric	0	643	110	85.4
		1	124	97	43.9
	Overall Percentage				76.0
The cut value is .250, 0 = non-enrollment, 1 = enrollment.					

Table 9

SPSS Classification Table Output, HEI #3

Classification Table ^a					
Observed			Predicted		
			matric		Percentage Correct
			0	1	
Step 1	matric	0	419	4	99.1
		1	94	24	20.3
	Overall Percentage				81.9
	Step 2	matric	0	380	43
1			69	49	41.5
Overall Percentage				79.3	
Step 3		matric	0	380	43
	1		69	49	41.5
	Overall Percentage				79.3
	The cut value is .250, 0 = non-enrollment, 1 = enrollment.				

Each independent variable was tested to determine if it contributed significantly to the accuracy of the enrollment prediction by adding the covariates into the equation. In all three models, Block 1 of the SPSS output (refer back to Tables 4, 5, and 6) employed a forward stepwise conditional method which assessed all independent

variables, putting them in one at a time (called a “step” in SPSS) and starting with the one that provided the most power to the model. The second most powerful predictor was added and so on until one of the variables was found not to be significant. Convergence, the point at which no additional variables being tested accounted for a significant proportion of the variance explained (Hosmer et al., 2013), was reached at step 5 for HEI #1, step 4 for HEI #2, and step 3 for HEI #3. Steps here refer to the number of independent variables that accounted for a significant proportion of the variance explained. The results of the Forward Stepwise Conditional method appear in Tables 10, 11, and 12.

Table 10

SPSS Output of Forward Stepwise Conditional Method, HEI #1

		Variables in the Equation							
		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Step 1 ^a	falsa_count_dummy1	4.199503	0.357901	137.679732	1.000000	< .001	66.653199	33.050279	134.420921
	Constant	-1.781607	0.084149	448.258364	1.000000	< .001	0.168367		
Step 2 ^b	falsa_position_dummy1	1.895235	0.178982	112.125943	1.000000	< .001	6.654114	4.685331	9.450184
	fice_count_dummy1	2.996477	0.370273	65.490581	1.000000	< .001	20.014891	9.686719	41.355165
	Constant	-2.473816	0.126274	383.803711	1.000000	< .001	0.084263		
Step 3 ^c	merit_award	0.000088	0.000015	33.831622	1.000000	< .001	1.000088	1.000058	1.000118
	falsa_position_dummy1	1.964775	0.184690	113.172464	1.000000	< .001	7.133306	4.966870	10.244691
	falsa_count_dummy1	3.056782	0.379124	65.008066	1.000000	< .001	21.259035	10.111904	44.694508
	Constant	-4.322452	0.356375	147.111510	1.000000	< .001	0.013267		
Step 4 ^d	merit_award	0.000117	0.000017	46.437475	1.000000	< .001	1.000117	1.000083	1.000151
	best_test_composite	-0.002655	0.000662	16.093619	1.000000	0.000060	0.997348	0.996055	0.998643
	falsa_position_dummy1	1.888126	0.186858	102.102698	1.000000	< .001	6.606978	4.580878	9.529211
	falsa_count_dummy1	3.028320	0.383456	62.369387	1.000000	< .001	20.662484	9.745045	43.810803
	Constant	-1.743065	0.716391	5.920076	1.000000	0.014969	0.174983		
Step 5 ^e	merit_award	0.000122	0.000018	48.415072	1.000000	< .001	1.000122	1.000088	1.000157
	best_test_composite	-0.003441	0.000761	20.464671	1.000000	0.000006	0.996564	0.995080	0.998051
	falsa_position_dummy1	1.860206	0.187609	98.314386	1.000000	< .001	6.425062	4.448204	9.280471
	falsa_count_dummy1	3.023833	0.384457	61.861442	1.000000	< .001	20.569990	9.682414	43.700308
	test_optional	-0.712024	0.333764	4.551044	1.000000	0.032899	0.490650	0.255077	0.943783
	Constant	-0.831564	0.826388	1.012566	1.000000	0.314289	0.435368		
a. Variable(s) entered on step 1: falsa_count_dummy1.									
b. Variable(s) entered on step 2: falsa_position_dummy1.									
c. Variable(s) entered on step 3: merit_award.									
d. Variable(s) entered on step 4: best_test_composite.									
e. Variable(s) entered on step 5: test_optional.									

Table 11

SPSS Output of Forward Stepwise Conditional Method, HEI #2

Variables in the Equation									
		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Step 1 ^a	falsa_position_dummy1	1.659994	0.178159	86.816016	1.000000	< .001	5.259279	3.709176	7.457186
	Constant	-1.626092	0.095578	289.452705	1.000000	< .001	0.196697		
Step 2 ^b	falsa_position_dummy1	1.250303	0.196792	40.365943	1.000000	< .001	3.491401	2.374050	5.134634
	falsa_count_dummy1	2.486003	0.556682	19.942906	1.000000	0.000008	12.013158	4.034674	35.768929
	Constant	-1.626092	0.095578	289.452707	1.000000	0.000000	0.196697		
Step 3 ^c	Merit_award	0.000026	0.000012	4.914195	1.000000	0.026637	1.000026	1.000003	1.000049
	falsa_position_dummy1	1.278737	0.198178	41.634548	1.000000	< .001	3.592101	2.435900	5.297093
	falsa_count_dummy1	2.589013	0.560866	21.308399	1.000000	0.000004	13.316617	4.435926	39.976386
	Constant	-2.063546	0.223942	84.909583	1.000000	< .001	0.127003		
Step 4 ^d	Merit_award	0.000058	0.000015	15.851692	1.000000	0.000069	1.000058	1.000030	1.000087
	best_test_composite	-0.003178	0.000859	13.692901	1.000000	0.000215	0.996828	0.995151	0.998507
	falsa_position_dummy1	1.260503	0.199697	39.842194	1.000000	< .001	3.527194	2.384771	5.216894
	falsa_count_dummy1	2.502055	0.565037	19.608335	1.000000	0.000010	12.207560	4.033377	36.947825
	Constant	1.599631	1.005295	2.531936	1.000000	0.111563	4.951203		
a. Variable(s) entered on step 1: falsa_position_dummy1.									
b. Variable(s) entered on step 2: falsa_count_dummy1.									
c. Variable(s) entered on step 3: merit_award.									
d. Variable(s) entered on step 4: best_test_composite.									

Table 12

SPSS Output of Forward Stepwise Conditional Method, HEI #3

Variables in the Equation									
		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Step 1 ^a	falsa_count_dummy1	3.2863355	0.5519887	35.4456829	1.0000000	< .001	26.7446779	9.0653317	78.9025512
	Constant	-1.4945761	0.1141268	171.4986079	1.0000000	< .001	0.2243437		
Step 2 ^b	falsa_position_dummy1	1.2613789	0.2876897	19.2239453	1.0000000	0.0000116	3.5302860	2.0087597	6.2042859
	falsa_count_dummy1	2.2364452	0.5977522	13.9982639	1.0000000	0.0001830	9.3599990	2.9004690	30.2053158
	Constant	-1.7060647	0.1308600	169.9719895	1.0000000	< .001	0.1815790		
Step 3 ^c	merit_award	0.0000316	0.0000160	3.8794653	1.0000000	0.0488801	1.0000316	1.0000002	1.0000630
	falsa_position_dummy1	1.3438876	0.2934994	20.9658043	1.0000000	0.0000047	3.8339195	2.1568297	6.8150667
	falsa_count_dummy1	2.3508984	0.6075370	14.9734616	1.0000000	0.0001090	10.4949946	3.1904045	34.5238074
	Constant	-2.2217902	0.3008229	54.5486815	1.0000000	< .001	0.1084149		
a. Variable(s) entered on step 1: falsa_count_dummy1.									
b. Variable(s) entered on step 2: falsa_position_dummy1.									
c. Variable(s) entered on step 3: merit_award.									

The logistic regression procedure in SPSS produced a Wald statistic for each variable which tested the unique contribution of each predictor to the enrollment outcome, holding constant the other predictors and eliminating any overlap between them (Burns & Burns, 2008). As outlined earlier in Tables 10, 11, and 12, a Wald statistic was produced for all variables in each of the models.

The Exp (β) column in the tables show the extent to which raising the corresponding measure by one unit influences the likelihood of enrollment. Exp (β) can be interpreted in terms of the change in odds. When the value exceeds 1 the odds of enrollment occurring increase. The Exp (β) value associated with a merit aid award from the first HEI is 1.00012. As shown in Table 10 for HEI #1, there is a 95% probability that each dollar of merit aid will increase the likelihood of enrollment by between .0088% and .0157%.

Table 10 reflects the results of a logistic regression model for the first HEI that was statistically significant, $\chi^2(5) = 460.928, p < .0001$ (where exponentiated beta values at five degrees of freedom have a chi-square of 460.928, significant at the p value level of .0001). The model explained 48% (Nagelkerke R^2) of the variance in enrollment and correctly classified 82% of the cases (2016). As indicated by the exponentiated B value, or Exp (β), students who listed only HEI #1 on their FAFSAs were about 20 times as likely to enroll as those who listed more than one institution, controlling for other variables. Students who listed HEI #1 first among other institutions to which they sent their FAFSA results were more than six times as likely to enroll at HEI #1. As indicated in the SPSS output featured in Table 10, there was a 95% chance that with every point higher on the SAT, students admitted to HEI #1 were between .995 and .998 times less

likely to enroll at HEI #1. Though not as powerful a predictor, test optional admission election also significantly accounted for the variance explained. Those who elected not to have their test score considered as a component of their application qualifications were about half as likely to enroll at HEI #1. Distance from home, in-state residency, sex, race, and ethnicity did not significantly account for the variance explained.

As evident from Table 11, the logistic regression model for HEI #2 was statistically significant, $\chi^2(4) = 135.430, p < .0001$. The model explained 20% (Nagelkerke R^2) of the variance in enrollment and correctly classified 76% of the cases. Controlling for other variables, students who listed only HEI #2 on their FAFSAs were about 12 times as likely to enroll as those who listed more than one institution. For students who listed HEI #2 first among other institutions to which they sent their FAFSA results, they were about three and one-half times as likely to enroll at HEI #2. There is a 95% chance that each dollar of merit aid offered by HEI #1 increases the likelihood of enrollment by between .0030% and .0087%. There is a 95% likelihood that with every point higher on the SAT, students admitted to HEI #2 are between .995 and .999 times less likely to enroll at HEI #2. Distance from home, in-state residency, sex, race and ethnicity fell out of the model and did not significantly account for the variance explained.

The results reflected in Table 12 demonstrate that the logistic regression model for HEI #3 was statistically significant, $\chi^2(3) = 77.785, p < .0001$. The model explained 21% (Nagelkerke R^2) of the variance in enrollment and correctly classified about 79% of the cases. Controlling for other variables, students who listed only HEI #3 on their

FAFSAs were about 10 and one-half times as likely to enroll as those who listed more than one institution. For students who listed HEI #3 first among other institutions to which they sent their FAFSA results, they were almost four times as likely to enroll at HEI #3. There is a 95% chance that each dollar of merit aid offered by HEI #3 will increase the likelihood of enrollment by between .000015% and .0063%. Distance from home, high test score composite, in-state residency, sex, race and ethnicity did not significantly account for the variance explained.

Post hoc testing. The results of the quadratic term established through merit aid were squared to test for linearity and demonstrated no significant result. The term fell out of the model and allowed for the conclusion that the relationship between merit aid and enrollment is logistic. This was an important test to run since a simulation was created that illustrated the relationship between merit aid and enrollment. Increases in merit aid were positively related to increases in enrollment yield. However, the relationship was not linear.

The original models included an independent variable that reflected the precise amount of merit aid offered. After the models were constructed, the independent variables of merit aid were removed and replaced with merit aid as a percentage of the comprehensive fees at each institution to test the possibility that more power may be observed in the merit aid as a percentage of comprehensive fee variable. The new models yielded very similar results; the merit aid as a percentage of comp fee variable performed the same (with a nearly identical Wald statistic) and the model performed the same (with a very similar chi squared). These results suggest that these two variables were assessing similar constructs.

Summary of Findings

The data in each of these models was normally distributed. At all three institutions, merit aid was shown to have a significant positive relationship with enrollment yield. Table 13 contains yield simulations that utilize the model built for each of the HEIs in this study to predict enrollment at varying levels of merit aid. To calculate the simulations, each independent variable was multiplied by the Beta value in the SPSS output and added together. Then the exponentiation formula was run to convert the sum to a value between 0 and 1 (to show likelihood of enrollment). Next, the same process was followed but without the merit aid award variable. Then simulated values of merit aid in increments of \$500 were substituted for actual merit awards. The exponentiation formula was run again to arrive at probability scores for enrollment using the simulated merit award values.

The results in Table 13 represent how an enrollment manager, using logistic regression to determine the relationship between merit aid and enrollment, can effectively manage the size of an entering class through the award of merit aid. Controlling for other variables, merit aid can be used to reliably predict who will enroll. Each admitted student can thus be assigned a probability score based upon this procedure and an enrollment manager can use those probabilities to carefully craft the size of the entering class of students. The simulations represented in Table 13 and Figure 9 illustrate the relationship between merit aid and enrollment yield. They reflect the expected yields on offers of admission and merit aid if all students at the three HEIs were awarded the *same amount* of merit aid. Although similar simulations could be developed to account for differences in enrollment yield by academic qualifications, this illustration does not.

Table 13

Simulation of merit aid offers and likelihood of enrollment at three HEIs.

Merit Offer	HEI #1	HEI #2	HEI #3
\$0	6.1%	12.1%	15.8%
\$500	6.3%	12.4%	16.0%
\$1,000	6.6%	12.6%	16.1%
\$1,500	6.8%	12.9%	16.3%
\$2,000	7.0%	13.1%	16.5%
\$2,500	7.3%	13.4%	16.7%
\$3,000	7.5%	13.7%	16.8%
\$3,500	7.8%	13.9%	17.0%
\$4,000	8.0%	14.2%	17.2%
\$4,500	8.3%	14.5%	17.4%
\$5,000	8.6%	14.8%	17.6%
\$5,500	8.8%	15.1%	17.7%
\$6,000	9.1%	15.4%	17.9%
\$6,500	9.4%	15.7%	18.1%
\$7,000	9.7%	16.0%	18.3%
\$7,500	10.0%	16.3%	18.5%
\$8,000	10.3%	16.7%	18.7%
\$8,500	10.6%	17.0%	18.9%
\$9,000	10.9%	17.3%	19.1%
\$9,500	11.3%	17.7%	19.3%
\$10,000	11.6%	18.0%	19.5%
\$10,500	12.0%	18.4%	19.7%
\$11,000	12.3%	18.7%	19.9%
\$11,500	12.7%	19.1%	20.1%
\$12,000	13.1%	19.4%	20.3%
\$12,500	13.5%	19.8%	20.5%
\$13,000	13.9%	20.2%	20.7%
\$13,500	14.3%	20.6%	20.9%
\$14,000	14.7%	21.0%	21.1%
\$14,500	15.2%	21.4%	21.4%
\$15,000	15.6%	21.8%	21.6%
\$15,500	16.1%	22.2%	21.8%
\$16,000	16.6%	22.6%	22.0%
\$16,500	17.1%	23.1%	22.2%
\$17,000	17.6%	23.5%	22.5%
\$17,500	18.1%	23.9%	22.7%
\$18,000	18.6%	24.4%	22.9%
\$18,500	19.2%	24.8%	23.2%

\$19,000	19.8%	25.3%	23.4%
\$19,500	20.4%	25.7%	23.6%
\$20,000	21.0%	26.2%	23.9%
\$20,500	21.6%	26.7%	24.1%
\$21,000	22.2%	27.2%	24.3%
\$21,500	22.9%	27.7%	24.6%
\$22,000	23.6%	28.1%	24.8%
\$22,500	24.3%	28.6%	25.1%
\$23,000	25.0%	29.2%	25.3%
\$23,500	25.7%	29.7%	25.6%
\$24,000	26.4%	30.2%	25.8%
\$24,500	27.2%	30.7%	26.1%
\$25,000	28.0%	31.2%	26.3%
\$25,500	28.8%	31.8%	26.6%
\$26,000	29.6%	32.3%	26.9%
\$26,500	30.5%	32.9%	27.1%
\$27,000	31.3%	33.4%	27.4%
\$27,500	32.2%	34.0%	27.7%
\$28,000	33.1%	34.5%	27.9%
\$28,500	34.0%	35.1%	28.2%
\$29,000	35.0%	35.7%	28.5%
\$29,500	35.9%	36.2%	28.7%
\$30,000	36.9%	36.8%	29.0%
\$30,500	37.9%	37.4%	29.3%
\$31,000	38.9%	38.0%	29.6%
\$31,500	39.9%	38.6%	29.9%
\$32,000	40.9%	39.2%	30.1%
\$32,500	42.0%	39.8%	30.4%
\$33,000	43.1%	40.4%	30.7%
\$33,500	44.1%	41.0%	31.0%
\$34,000	45.2%	41.6%	31.3%
\$34,500	46.3%	42.2%	31.6%
\$35,000	47.5%	42.9%	31.9%
\$35,500	48.6%	43.5%	32.2%
\$36,000	49.7%	44.1%	32.5%
\$36,500	50.9%	44.8%	32.8%
\$37,000	52.0%	45.4%	33.1%
\$37,500	53.2%	46.0%	33.4%
\$38,000	54.3%	46.7%	33.7%
\$38,500	55.5%	47.3%	34.0%
\$39,000	56.7%	47.9%	34.3%
\$39,500	57.9%	48.6%	34.6%
\$40,000	59.0%	49.2%	34.9%

Figure 9 represents what-if scenarios that plot enrollment yield curves for the purpose of visualizing the predicted impact of varying degrees of merit aid on enrollment yield at each of the three HEIs. One could speculate that the differences in the slopes are a reflection of institutional prestige. As referenced earlier, HEI #3 is the most selective in admission of the three HEIs; it also has the highest average entrance examination test scores. Students admitted to HEI #3 are also admitted at some of the most reputable HEIs in the United States. It could be argued that those students who apply for admission at more prestigious HEIs are influenced differently by offers of merit aid or, alternatively stated, that they are more affected by the prestige associated with enrollment at a particular HEI than they are financial incentives that factor into the enrollment decision.

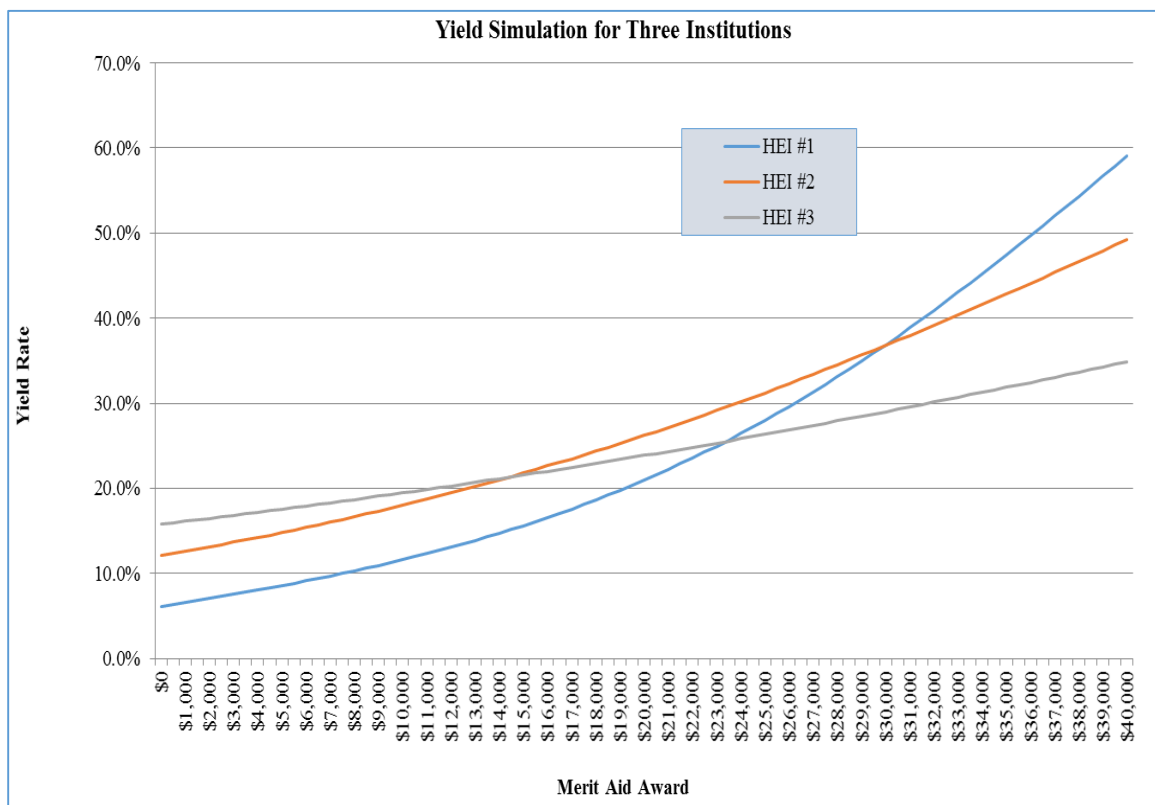


Figure 9. Yield simulation curves for three HEIs.

Chapter 5: Discussion

Although the intent of the study was not to compare the three institutions or explain any of the variability in their yield on offers of admission, the yield rates were remarkably similar (21%, 23%, and 22% respectively). It would be inappropriate to draw conclusions from these apparently parallel yield data or any of the variables that might inform the likelihood of enrollment because the institutions have very different reputations, students, and positions in the marketplace. It is interesting, nonetheless, to consider the possibility that by testing a variety of independent variables at unique institutions, one could arrive at a better understanding of which variables tend to be significant predictors of student enrollment.

High test score average showed up as a variable that significantly accounted for a proportion of the variance explained for HEI #1 and HEI #2. In the case of HEI #3, the high scores are considerably more compressed among admitted students which may help to explain why variations in test scores did not significantly affect predictions. The test optional election available only at HEI #1 was also a significant variable with a p value of .033.

This study was intended to isolate the merit aid variable, controlling for several other factors. Merit aid added significantly to the proportion of enrollment variance explained at all three institutions in the study. This was the expected outcome in light of the Avery & Hoxby study (2004) that tested merit aid as a predictor of enrollment yield on offers of admission. One could also conclude that the number and order in which an HEI appears on the list of institutions to which a student decides to transmit a FAFSA is a strong predictor of student enrollment. In fact, no other variables tested in this study

predict enrollment with greater accuracy than the FAFSA listing information. It is unfortunate, therefore, that the Department of Education in Washington, DC has recently announced a decision to terminate their practice of including the ordered listing of institutions to which students have directed their FAFSAs on the reports sent to colleges. However, that decision makes the predictive qualities of merit aid essential as, at least in the cases of these three institutions, nothing aside from FAFSA listings predicted enrollment with greater accuracy. Although significant at all three of the HEIs in the study, merit aid was not found to be associated with the same level of predictive power at HEI #3 as the other two institutions. This may be accounted for by the fact that HEI #3 charges considerably more for tuition, is a national liberal arts college, and attracts exceptional applicants for admission who are also considering the possibility of enrollment at some of the most reputable HEIs in the United States. Therefore, it is possible that even additional offers of merit aid would be insufficient to persuade students to enroll instead of accepting offers of admission, even without offers of merit aid, to other highly recognized HEIs.

In none of the models did distance from home or in-state residency account for a significant proportion of the variance explained. A significant share of students at HEIs #1 and #2 were in-state residents (64% and 67%, respectively, in 2014). At HEI #3, students hail from all 50 states and more than 50 countries. Fewer than 10% of students at HEI #3 were in-state residents in 2014. With such a prominent international reputation, HEI #3 attracts attention from students who are less likely to be concerned about the distance of their chosen college from their home.

Sex was also not a significant variable. Apparently, there are no significant differences between how men and women are affected by the range of tested variables in the college choice process. Of course, if any of the studied institutions had been single-sex institutions or heavily weighted toward one sex or the other, this result could have been much different. Race and ethnicity were also not significant variables in any of the models. Only 2.4% of all students who qualified for inclusion in these models were African American and 3.0% were Hispanic. This was also not a surprising result given what was learned in the Avery and Hoxby study—that African Americans and Hispanics are underrepresented among students with no demonstrated financial need.

A variety of other psycho-social factors not tested in this study may contribute to yield rates on offers of admission and student response to offers of merit aid. For example, from a sociological credentialing perspective, consumers of higher education may be influenced by their perception of how prospective employers or graduate and professional schools will look upon them in conjunction with a future application for employment or admission depending upon the college or university they attended. Similarly, perceptions of the reputation of a specific academic program may influence the enrollment choices of students. An example of this is the favorable reputation a particular HEI has for educating teachers. Such a college or university that began as a Normal School may well benefit from a long-standing reputation for teacher training. Where professionals who are prominent in a particular field went to school may also serve to inform the perception of academic program strength among college-bound students and those who influence them.

The location of a HEI in a particular geographic center may also influence the enrollment decisions of students who have a special interest in a subject or discipline that is engaged by prominent professionals or institutions. Students interested in public policy, for example, may be more likely to attend a HEI located in Washington, DC. Others interested in finance or investment banking may be attracted to HEIs in New York City. Those interested in the technology sector may find enrollment appealing at a HEI in California's Silicon Valley or the Research Triangle Park in North Carolina. HEIs that offer frequent internships with organizations in close proximity to their campuses may further enhance the impressions of prospective students on programmatic efficacy. Such factors as these are unaccounted for in this study although it is possible that offers of merit aid serve to compensate for weaker perceptions associated with a particular HEI.

Price Responsiveness

The results of the models developed in this study clearly suggest that the level of price responsiveness decreases with the selectivity of the institution. However, because this study did not include techniques designed to assess the variability in yield results based upon institutional differences, one can only speculate about potential institutional differences that could help explain variability in enrollment yield. One such difference that may account for some of the difference in yield results is the overall price sensitivity of the students who comprise the market of the three different HEIs. Notably, no student in the two-year study applied to more than one of the institutions analyzed. It is also clear that students who were admitted at HEI #1 the least selective (i.e., highest admit rate) of those in the study were more price responsive, meaning that the lower the net price, the higher their likelihood of enrollment. Students admitted at HEI #3, the most

selective of the institutions, were the least price responsive. This may suggest that students without financial need who apply to more highly selective institutions are less concerned about price and more concerned about being enrolled at a college they perceive as having a strong reputation among employers or graduate and professional schools.

Another possibility to consider is that HEI #1 may attract students who are more likely to think of higher education in the way they think about other consumer goods where discounts are more commonplace, expected, and play a greater role in purchase decisions. At HEI #3, it is likely that their prospective students think of them as more of a luxury good where a premium charged by the college is acceptable given their reputation and similarities with some of the most highly respected liberal arts colleges in the country.

Price responsiveness curves. One may conclude from the results of this study that a HEI could use this modeling framework to identify a price responsiveness curve that illustrates the relationship between merit aid and enrollment yield. Because enrollment managers are often concerned with the amount of student revenue generated through enrolled classes of students, they could focus not only on the amount of merit aid necessary to positively influence enrollment but on the resulting amount of net tuition after applying merit aid. The peak of such a price curve, therefore, would represent the optimal nexus between merit aid investment and net revenue from students.

Impediments to maximizing student revenue through merit aid. Given the challenges associated with higher education cost structures outlined earlier, one might ask why an enrollment manager wouldn't simply plot such price responsiveness curves and

offer the amount of merit aid that would help generate the highest amount of revenue. There are other constraints and goals to consider. Not all HEIs seek to enroll as many students as possible. In the case of the three HEIs in this study, two of them would be pleased to enroll as many qualified students as possible and one has capacity constraints to observe. When exceeding the number of seats available in classrooms and residence halls would serve to compromise the learning experience, an enrollment manager could appropriately conclude that moving to the peak of a price responsiveness curve for all admitted students would lead to an excess of entering students. Another consideration is that moving to the peak of a price responsiveness curve for all admitted students may result in the enrollment of far too many students with weak qualifications for admission. Although not the focus of this study, it is possible that optimizing net revenue could come at the expense of enrolling students who are not prepared for the academic rigor of a particular HEI.

Although additional merit aid may have the effect of increasing enrollment and net revenue, governing boards of a particular HEI may establish a ceiling for the tuition discount rate of an entering class of students, ironically reducing the amount of revenue that could be generated through financial aid leveraging. Another reason not to maximize revenue is that a strategy for awarding merit aid on a competitive basis is necessary to avoid a situation where less qualified applicants for admission are awarded more in scholarship support than those with stronger admission credentials. This could be especially problematic when students at the same high school are awarded different amounts of merit aid by the same HEI and those with lower credentials receive more in scholarship than those with stronger qualifications. Enrollment managers might also

approach the award of merit aid with a degree of risk aversion. It is possible that offering too much merit aid to those who require considerable financial incentive to enroll could result in having too many students with high volume merit awards enrolling thereby potentially increasing the discount rate to an unsustainable level.

The effect of market perceptions on enrollment yield rates. An important question grows out of this study specifically related to data presented in Table 7 and Figure 9 above. What accounts for the differences in yield rates associated with the same level of merit aid from one HEI to the next? An obvious explanation that has been referenced previously is that there are likely many factors that conspire to inform a student's college preference and several of them were not tested in this study. Without controlling for all possible variables, it would be inappropriate to assert causality related to any variable. Of course, that would not preclude the possibility of further study aimed at isolating additional variables that may add strength to a predictive model. One of those variables may be the HEI's overall reputation and how a student perceives a particular HEI among other institutions she is actively considering. It is possible that an institution's reputation could help explain some of the variability in enrollment yield rates from one institution to the next. It is also likely, given what was learned from this study about the predictive power of merit aid, that adjustments in merit aid could be utilized to effectively compensate for a somewhat weaker institutional brand or identity as compared to how competitors may be perceived by prospective students.

Future Study

The role of market position. The review of literature for this study revealed few references to understanding the role of an institution's reputation or brand and

quantifying the impact of the HEI's market position—how it is perceived by prospective students within a competitive context—on the level of merit aid (or tuition discount) required to inspire desirable enrollment behaviors. Nearly all but the strongest brand-name schools nationally sponsor a merit aid program. With some notable exceptions, those without merit aid programs are typically concentrated at the top of national college rankings and have sizeable endowments. They publically oppose any financial aid that is not need-based and enjoy the luxury of enrolling many of the most qualified students in the country, nearly one-half of whom pay the full comprehensive fee to attend their institutions (National Center for Education Statistics, 2012).

As acknowledged, several factors not accounted for in this (or any) study of enrollment yields affect student enrollment choices. That methodological conundrum notwithstanding, this study illustrated the strong, positive relationship between merit aid and enrollment yield. It has also been determined that people will pay more for something they associate with great value (Völckner, 2005). It could be said that the ultimate success of enrollment managers, as measured by net student revenues, is reflected in their capacity over time to charge a premium for their educational product that a significant number of students who are capable of paying are also willing to pay. This study demonstrated that willingness to pay what an HEI determines it must charge can be influenced with merit aid but, as examined earlier, that tuition discounting practice may be a dubious investment if so much of a discount is offered to entering students that it poses risk to the financial health of a HEI. How then can an HEI avoid discounting their prices and still achieve their enrollment goals? Perhaps by remaining relevant to their constituents and building their reputation for ensuring the success of their students

and alumni, HEIs may be able to increase the perceived value associated with their institutions. Failure to achieve a high degree of institutional value could require increasing amounts of merit aid (and surrendering tuition revenue in the process) to realize enrollment targets, even to the point of financial exigency. Therefore, HEIs are often attentive to their institutional brands—the thoughts, feelings, and associations of them in the minds of prospective students (Crow, 2010; Gates, 2010). In order to maximize net student revenues by offering less merit aid, HEIs could seek to improve their value proposition and to strengthen their competitive position in the marketplace.

The brand gap. Sometimes in spite of an HEI's best efforts to improve upon their market position, when a prospective student and her influencers conclude that the amount of money required to enroll at a particular HEI is higher than they believe enrollment at that institution is worth, a "brand gap" could be said to exist. The concept of a brand gap refers to scholarly work done to understand the difference between the net price of a good or service (tuition and fees) after a coupon (tuition discount) is offered to a prospective consumer and the perceived worth of acquisition or ownership (enrollment) by the potential consumer. If the discounted price seems higher than what a consumer is willing to pay, a brand gap exists (Neumeier, 2006).

Willingness to pay. It is conceivable that the amount of merit aid necessary to positively influence an enrollment decision is a function of institutional brand strength. It is also possible that the qualifications of an individual applicant affected her willingness to pay what was charged by an HEI to enroll. Perhaps the stronger a student's qualifications for admission, the less willing he was to pay the full cost of attendance. An exception to this would be the student from a family with significant wealth who is

admitted to Harvard and perfectly willing to pay the comprehensive cost of attendance for the opportunity to enroll. For most students applying to most institutions, however, the logic utilized may be revealed in some version of the following statement: “I worked hard to earn good grades, participate in activities, and achieve high test scores—I should be recognized for that hard work with a scholarship.” Such a student may be less willing to pay the costs of attendance at an institution she believes has a weaker reputation or brand. Were this student admitted at Harvard she may well decline a full-tuition scholarship offer from a HEI she perceives to be less prestigious or desirable.

Closing the brand gap. With tuition discounting, the use of merit aid, and a logistic regression model like the ones developed for this study, an enrollment manager could look for the “sweet spot” where a prospective student’s merit aid award goes only as high as necessary to create an adequate incentive for enrollment or to adequately compensate for a brand gap. One way of viewing an institutional investment in merit aid, therefore, is to view it as the cost or measure of compensation for a weak institutional value or brand. It is possible that strengthening an institution’s reputation or brand can serve to mitigate loss of institutional tuition revenue that is incurred through investment in merit aid. Following this idea, the less desirable enrollment is to a student, the higher the discount required to ensure his enrollment. In some cases, no amount of money may be enough to sway the enrollment decision or compensate for a weak brand. In other cases, perhaps the qualifications of a student would not warrant the level of investment in merit aid required to ensure their enrollment. Applying the concept of a brand gap to the context of the higher education marketplace for students, more of the price associated

with the costs of education could be charged to the student if the value associated with enrollment at a particular institution is positive and significant.

This may help to explain why millions of dollars in advertising and coaching contracts are expended to achieve loyalty among college sports teams. Brand and institutional market position—how an HEI compares to others in a student's consideration set of HEIs—are influenced by the characteristics of a student body. The academic profile of an entering class and the rate at which applicants are offered admission are prominent factors in the methodology of some prominent national college rankings (Bastedo & Bowman, 2010). Thus, the academic profile of entering students can serve to improve a college's market position or diminish it. If many students decline the offer of admission and financial aid, an increase in the number of offers is required. This decreases a HEI's selectivity or increases their admit rate which, in turn, reflects negatively on their rating in national rankings. Because value perception can be negatively affected by a HEI's drop in the rankings (Bastedo & Bowman, 2010), an increase in institutional aid may be necessary to compensate for it. Therefore, to the extent that offers of merit aid create enrollment incentives for qualified students and serve to increase the yield on offers of admission, thereby decreasing the admit rate, it can be said that merit aid could play a crucial role in strengthening institutional brand.

Treatment of a brand gap with merit aid. If the brand gap is precisely valued at the amount of merit aid projected to yield the desired enrollment behavior, one might say that a HEI could reconcile a brand gap with a sufficient merit aid award. Accepting the premise that the monetary value associated with the brand gap varies in proportion to a students' perceptions of a college, his desire to attend and his qualifications for

admission, the value of a brand gap could be represented by the following formula where SP represents Sticker Price of attendance, PV represents Perceived Value of enrollment (the amount a student is willing to pay) and BG is the resulting value of the Brand Gap.

$$SP - PV = BG$$

In this way, the brand gap could be thought of as a dollar value equal to the cost of having a weak brand, requiring an HEI to compensate for it through the use of discounting. When a brand gap exists, a discount (in the form of financial aid) at a level up to the value of the brand gap could, under certain conditions, result in an affirmative enrollment decision. If a college could quantify a student's perception of its institutional value and the student's corresponding willingness to pay a particular dollar value for the education, it may be possible to affect an enrollment decision. It may not always be necessary to award the full difference in merit aid between what a family is judged as able to afford (EFC) and the balance due after all forms of need-based aid have been applied to a student's financial aid package. For instance, when there is no disagreement between the net price (*sticker price – financial aid*) and the PV , there is no brand gap for which to compensate. As mentioned earlier, there are many variables that influence the enrollment decisions of students (e.g., self-perception of a student's qualifications for admission, parent preferences, majors, location, campus visit experience, friends and significant others) and many of them are beyond the scope of a HEI to influence. However, a merit award and resulting net price could serve to neutralize some of the impediments to enrollment perceived by the student and the people who influence her.

To illustrate these points, take for example the hypothetical student, Merry Day, a college-bound student with no demonstrated financial need who is offered admission at

her first choice college, My Favorite University (MFU), which has a comprehensive fee of \$50,000. Merry perceives enrollment at MFU to be worth the price she must pay. No brand gap or cost associated with it exists in this example. In the absence of a compelling alternative, Merry is likely to enroll at MFU.

MFU's Brand Gap Value

$$SP - PV = BG$$

$$\$50,000 - \$50,000 = \$0$$

But Merry may be persuaded by a financial aid offer from her second choice college, MNFU (My Next Favorite University), which has a sticker price of \$48,000, if MNFU represents a close enough second choice to MFU and if the brand gap at MNFU is addressed by a financial aid offer (the net price is lowered by a merit aid award) of, say, \$8,000. If she perceives MNFU to be an acceptable alternative to MFU, she may be willing to accept a financial aid offer of \$8,000 in merit aid per year from MNFU, especially because her net price will be \$40,000 less to attend there over four years. In this case, the value of the brand gap at MNFU was \$10,000 (\$8,000 required in merit aid and \$2,000 lost from not having a strong enough market position to effectively increase their sticker price to equal that of MFU's).

MNFU'S Brand Gap Value

$$SP - PV = BG$$

$$\$48,000 - \$40,000 = \$8,000$$

In the example above, a merit aid award was instrumental in reversing Merry's decision to attend her first choice institution. If MNFU had not been a close contender for Merry's enrollment, a more significant investment of financial aid would have been

required for her to reconsider the rank order of her top choices. Only Merry and those advising her could decide if it is worth \$40,000 more over four years to enroll at MFU. Depending upon how much stronger their regard for MFU was compared to their perception of MNFU, even \$40,000 may not have deterred Merry from enrolling at her first choice institution. However, when the amount of merit aid is sufficient to close the brand gap, a decision to enroll may be reached, assuming the student is otherwise open to the possibility of enrollment.

The relationship between institutional brand and merit aid, therefore, may be critical to manage. When executed properly, the HEI could charge a net price closer to its actual cost of operation per student in order to generate more revenue for operations. In the example above, MNFU is utilizing merit aid to compensate for a market position that is weaker than MFU's. If Merry enrolls there, it could be argued that their weaker market position will carry a brand compensation cost of \$10,000. Herein lies one reason why HEIs may spend time discussing their standing in "the rankings" and expend advertising and recruiting dollars in an effort to bolster their brands. A strong brand may require less of an investment in merit aid. It could also be argued that the use of merit aid was instrumental in enrolling a student who would pay \$40,000 to attend. The merit aid created an incentive for Merry's enrollment and could be viewed as a wise investment of institutional dollars because it generated revenue now available for other institutional commitments, perhaps even an investment in their need-based aid program. In this example, it becomes apparent that a merit aid program can serve to both strengthen an institutional brand and create a revenue stream to address their increasing costs and replace subsidies that institutions no longer receive from State and Federal governments.

Modeling to inform merit award values. The logistic regression models developed in this study demonstrated a strong, positive relationship between merit aid and enrollment. Through such a model, an enrollment manager could predict with some precision the amount of merit aid required to compensate for an existing brand gap. By accounting for a student's academic qualifications for admission, an enrollment manager may be able to assess their willingness to pay a particular amount of the comprehensive fee in order to attend their institution. Another way of looking at this is that there may be a value perception gap that exists and that gap, if properly interpreted and filled with just the right amount of merit aid could positively contribute to an enrollment decision.

Merit aid as an ally to revenue and low income students. When properly executed by HEIs with sufficient brand recognition and value, the student recruitment process can produce net revenues used to underwrite the costs of need-based financial aid, thereby contributing toward the enrollment of students from across the socio-economic spectrum. Figure 10 reflects the complexity and implications of interrelated factors impacted by a reduction or elimination in merit aid within the context of a competitive market environment. It represents the suggestion that an institution's capacity to reach all of its enrollment objectives can be negatively affected by a decision to acquiesce to the growing demands expressed by free-lance writers, higher education journalists, and even a growing number of higher education officials and scholars for the elimination of merit aid. HEIs expend considerable effort discussing and pursuing goals related to access and equity (Stevens, 2009). Several HEIs seek classes composed of a broad distribution of students from across the socio-economic spectrum. As demonstrated by Noel Levitz (2007), without financial aid, students with financial need often do not

enroll and without sufficient revenue generated through student enrollment, financial aid awarded to those with financial need may not be adequate for them to enroll.

Consequently, it is possible that the long-term prosperity of an institution's need-based financial aid program is dependent upon its capacity to enroll students from affluent backgrounds who are willing to pay all or a significant portion of the cost of their education. As illustrated by this study, merit aid can serve as a motivator to student enrollment among those students ineligible to receive need-based financial aid.

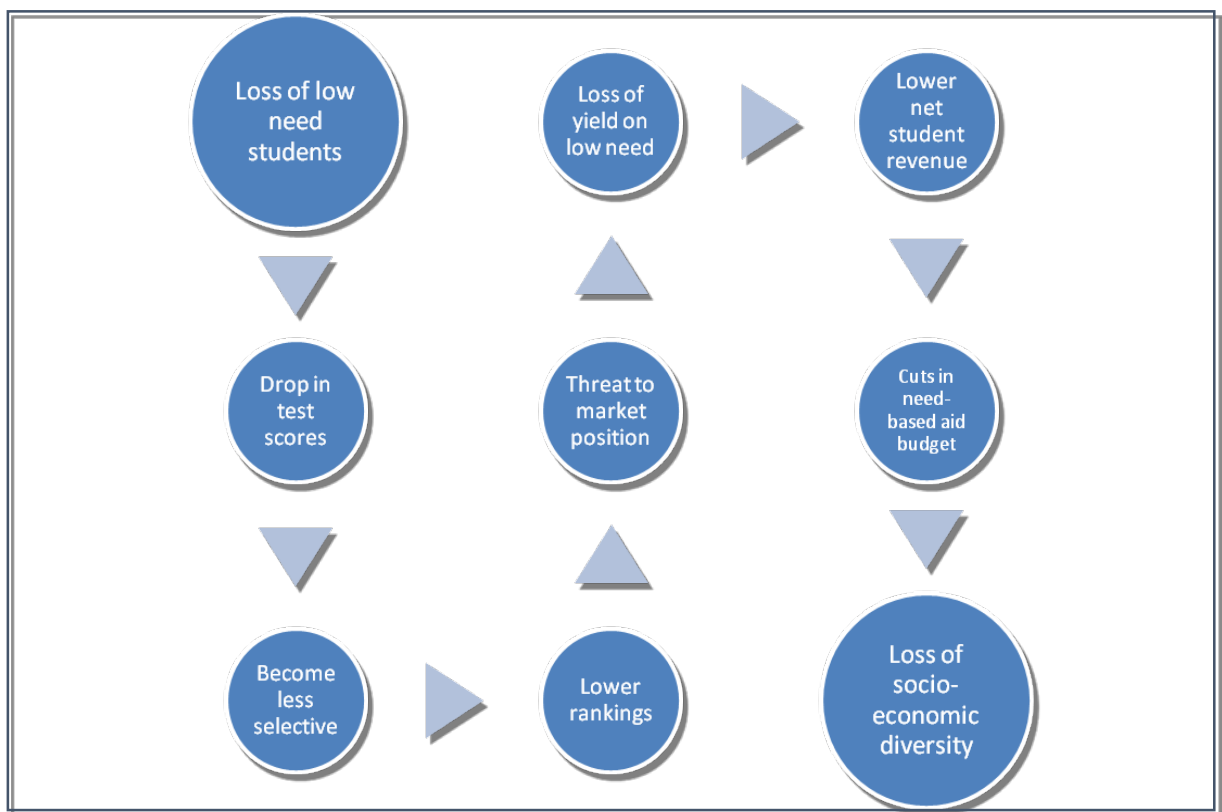


Figure 10. Chain reaction of merit aid reduction.

The fallacy of well-intended merit aid antagonists is that a decision to eliminate it would preserve institutional resources available to underwrite the costs associated with need-based aid to support socio-economic, racial and ethnic diversity in a student body. As suggested by the flowchart in Figure 10, elimination of merit aid could do more to compromise need-based aid through loss of overall net tuition revenue than imagined by those who do not understand the potential of merit aid to generate more net revenue than can be achieved without it.

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Joseph Paul Bagnoli, Jr.

3/15/16

EDUCATION

- | | |
|------|----------------------------------------------------------------------------------------------------------------------|
| 1992 | Master of Arts, Student Personnel Services for Higher Education
Eastern Kentucky University (Richmond, KY) |
| 2002 | Bachelor of Science, Business Administration
Berea College (Berea, KY) |

WORK EXPERIENCE

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|-------------------|--------------------------------------------------------------------------------------|
| 02/2012 – 03/2016 | Vice President for Enrollment, Dean of Admission and Financial Aid, Grinnell College |
| 05/2009 – 02/2012 | Dean of Enrollment and Academic Services, Berea College |
| 06/2001 – 05/2009 | Associate Provost for Enrollment Management, Berea College |
| 06/1997 – 06/2001 | Director of Admissions, Berea College |
| 06/1994 – 06/1997 | Director of Admissions and Financial Aid, Concord College |
| 08/1989 – 06/1994 | Assistant Director of Admissions/Admissions Counselor, Berea College |

AWARDS

- | | |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| 2012 | Elizabeth Perry Miles Community Service Award, Berea College |
| 2011 | Best New Campus Application: New Student Orientation and Course Registration System, Association of Independent Kentucky Colleges and Universities |
| 2010 | Black Cultural Center Award for Exceptional Community Service, Berea College |
| 2007/2009 | The Power of One Award, Black Cultural Center, Berea College |
| 2008 | Community Partner Award, Berea Community Independent High School |
| 2002 | Human Relations Award, Kentucky Association for Secondary and College Admissions Counselors |
| 2001 | Phi Kappa Phi Honor Society |
| 2000 | President's Award, Kentucky Association for Secondary and College Admissions Counselors |
| 1997 | Bonner Scholars Community Partner |
| 1996 | International Club Award of Special Merit |

PUBLICATIONS

- Shinn, L.D., & **Bagnoli, J. P.** (2011). Pell Grants: “Welfare” or Key to America’s Future? *Strategic Enrollment Management Source*. Retrieved from <http://www4.aacrao.org/semsource/sem/indexe5e6.html?fa=view&id=5214>
- Porter, D., **Bagnoli, J.**, Blythe, J., Hudson, D., Sergel, D. (2007). Organizing Student Services for Learning. In Kramer, G., *Fostering Student Success in the Campus Community* (pp. 262-301).

SELECTED PRESENTATIONS

- Strauss, D., **Bagnoli, J. P.**, Kabbaz, M. (2015, February). *Jumping on the Right Bandwagon: Pricing Strategies in Higher Education*. Panel Presentation of The College Board Midwest Forum, Chicago, IL.
- Hamborg, P., **Bagnoli, J. P.**, Kabbaz, M., Bauman, J. (2014, February). *Landing the Plane: Statistical Modeling to Predict Yield on Offers of Admission*. Panel Presentation of The College Board National Forum, Las Vegas, NV.
- Hamborg, P., **Bagnoli, J. P.**, Kabbaz, M., Bauman, J. (2013, February). *Does Merit Aid Have Merit?* Panel Presentation of The College Board National Forum, New York, NY.
- Bagnoli, J. P.** (2010, November). *Beating the Odds, Recruiting and Supporting Low-Income, First Generation Students*. Conference presentation to the American Association of College Registrar and Admissions Officers (AACRAO), Strategic Enrollment Management National Conference, Nashville, TN.
- Bagnoli, J. P.** (2010, February). *Raising the Glass Ceiling: Recruiting and Retaining Low-Income Students*. Conference presentation to the Southern Association of Student Financial Aid Administrators (SAFSAA), Louisville, KY.
- Bagnoli, J. P.** (2000, February). *The Storm Before the Calm: Organizing for Strategic Enrollment Management*. Conference presentation to the Southern Association of College Registrars and Admissions Counselors (SACRAO), Memphis, TN.
- Bagnoli, J. P.** (1993, February). *The Campus Visit: How to Increase Yield on Offers of Admission*. Conference presentation to the Southern Association of College Registrars and Admissions Counselors (SACRAO), Newport, KY.